H

APPENDIX H: (revised)

SOCIO-ECONOMIC IMPACT ANALYSIS

APPENDIX M:

TRIP GENERATION SURVEY REPORT

M

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QUANTIFICATION OF TURTLE BAY RESORT TRAFFIC PATTERNS REPORT

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Quantification of Turtle Bay Resort Traffic Patterns Report

OBJECTIVE

The primary objective of this project is to understand and summarize the travel patterns of Turtle Bay Resort guests and tenants as they arrive and depart from the property.

METHODOLOGY

Fielding was conducted from October 31, 2011 to November 6; 2011, fielding times are shown in Table 1 below. A total of nine interviewers were trained and set up at one of four different entrances and locations at Turtle Bay (Appendix B).

Interviewers conducted a very brief one minute survey with cars entering and leaving the Turtle Bay Resort. The survey guide can be found in Appendix A. At the beginning of the study respondents were very cooperative and willing to participate; however, there were spikes of repeat refusals on November 2 and again on November 4 from hotel and condo guests staying at Turtle Bay who were tired of doing the survey with us.

A total of 4,800 surveys were completed; however, there were another 1,000 surveys conducted that were repeat refusals over the seven day period. The margin of error of the completed interviews is +/-1 percent at 95 percent confidence interval. Interviewers tried to interview every car, but if there was heavy traffic interviewers resorted to interviewing every third car instead. Furthermore, if an interviewer noticed a bus, he/she stopped interviewing cars that were in front of the bus and allowed it to pass before continuing to interview cars. This was done to not disrupt the scheduled arrival and departure times of tour buses. Throughout the seven days approximately 3,800 cars were not interviewed due to these missed cars and heavy rains.

There were some noteworthy events that occurred at Turtle Bay that may have affected the traffic flow. Thursday (11/3) there was a pre-golf tournament dinner, with the golf tournament taking place on Friday (11/4). On Saturday (11/5) a concert was held at Turtle Bay.

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Table 1: Fielding dates

	Monday 10/31/11	Tuesday 11/1/11	Wednesday 11/2/11	Thursday 11/3/11	Friday 11/4/11	Saturday 11/5/11	Sunday 11/6/11
7:00AM							
8:00AM							
9:00AM							
10:00AM							
11:00AM							
12:00PM							
1:00PM							
2:00PM							
3:00PM							
4:00PM							
5:00PM							
6:00PM							
7:00PM							
8:00PM							

RESULTS

This is a summary of the analysis executed to-date. As discussed, there is an extensive amount of data, and it can be reviewed in multiple manners. SMS will be pleased to provide additional data as needed.

The following tables summarize the major traffic patterns by segments, day part, and weekend vs. weekday.

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Following is a breakdown of the drivers interviewed:

Table 2: Breakdown of drivers interviewed

DRIVERS INTERVIEWED		
	Number	Percent
Tourist - Hotel guest	1,070	16.8
Tourist - Condo guest	159	2.5
Tourist - Visiting	696	10.9
Oahu resident - Hotel guest	166	2.6
Oahu resident - Condo guest	328	5.2
Oahu resident - Visiting	1,299	20.4
NI resident - Hotel guest	6	0.1
NI resident - Condo guest	1	0.0
NI resident - Visiting	11	0.2
Employee	687	10.8
Condo resident	224	3.5
Construction	83	1.3
Drop off	72	1.1
Doesn't speak English	9	0.1
Repeat refusal	980	15.4
Total	5,791	90.9
No Driver Classification	577	9.1
Total	**6,368**	**100.0**

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Table 3: Arriving respondents by point of origin and driver definition

	Total		Driver Definition									
	Count	Col %	TBR hotel/condo		TBR visitor		TBR condo resident		Employee		Others	
			Count	Col %	Count	Col %	Count	Col %	Count	Col %	Count	Col %
Waialua	29	1.2%	4	0.5%	10	0.9%	1	0.9%	14	5.3%		
Haleiwa	202	8.6%	69	8.9%	84	7.3%	13	11.6%	32	12.1%	4	6.3%
Laniakea to Waimea bay	34	1.4%	18	2.3%	12	1.0%	2	1.8%	2	0.8%		
Three Tables beach to Kawela Beach	289	12.2%	81	10.5%	129	11.2%	19	17.0%	54	20.4%	6	9.5%
Kahuku	165	7.0%	61	7.9%	51	4.4%	13	11.6%	31	11.7%	9	14.3%
Laie	214	9.1%	67	8.7%	99	8.6%	22	19.6%	25	9.4%	1	1.6%
Hauula	83	3.5%	10	1.3%	34	3.0%	2	1.8%	34	12.8%	3	4.8%
Kaaawa	13	0.6%	5	0.6%	5	0.4%	1	0.9%	2	0.8%		
Windward	141	6.0%	34	4.4%	89	7.7%	4	3.6%	7	2.6%	7	11.1%
East Honolulu	20	0.8%	4	0.5%	13	1.1%	2	1.8%	1	0.4%		
Honolulu	728	30.8%	267	34.6%	405	35.2%	10	8.9%	25	9.4%	21	33.3%
Central Oahu	164	6.9%	36	4.7%	100	8.7%	4	3.6%	22	8.3%	2	3.2%
Leeward Oahu	141	6.0%	22	2.9%	99	8.6%	6	5.4%	6	2.3%	8	12.7%
Other	138	5.8%	93	12.1%	20	1.7%	13	11.6%	10	3.8%	2	3.2%
Total	2,361	100.0%	771	100.0%	1,150	100.0%	112	100.0%	265	100.0%	63	100.0%

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Table 4: Departing respondents by destination and driver definition

	Total		Driver Description									
	Count	Col %	TBR hotel/condo		TBR visitor		TBR condo resident		Employee		Others	
			Count	Col %	Count	Col %	Count	Col %	Count	Col %	Count	Col %
Waialua	38	1.8%	4	0.5%	9	1.1%			24	7.1%	1	1.6%
Haleiwa	221	10.5%	97	11.7%	63	8.0%	8	9.3%	48	14.2%	5	8.2%
Laniakea to Waimea bay	19	0.9%	8	1.0%	9	1.1%			2	0.6%		
Three Tables beach to Kawela Beach	257	12.2%	100	12.0%	97	12.4%	11	12.8%	46	13.6%	3	4.9%
Kahuku	175	8.3%	46	5.5%	44	5.6%	13	15.1%	67	19.8%	5	8.2%
Laie	233	11.1%	97	11.7%	68	8.7%	15	17.4%	48	14.2%	5	8.2%
Hauula	58	2.8%	11	1.3%	25	3.2%	1	1.2%	21	6.2%		
Kaaawa	18	0.9%	5	0.6%	4	0.5%			9	2.7%		
Windward	130	6.2%	34	4.1%	75	9.6%	4	4.7%	12	3.5%	5	8.2%
East Honolulu	18	0.9%	3	0.4%	11	1.4%	1	1.2%	2	0.6%	1	1.6%
Honolulu	468	22.3%	193	23.2%	240	30.6%	4	4.7%	16	4.7%	15	24.6%
Central Oahu	126	6.0%	38	4.6%	56	7.1%	2	2.3%	26	7.7%	4	6.6%
Leeward Oahu	99	4.7%	22	2.6%	55	7.0%			11	3.2%	11	18.0%
Other	151	7.2%	113	13.6%	18	2.3%	14	16.3%	2	0.6%	4	6.6%
Unknown	92	4.4%	61	7.3%	11	1.4%	13	15.1%	5	1.5%	2	3.3%
Total	2,103	100.0%	832	100.0%	785	100.0%	86	100.0%	339	100.0%	61	100.0%

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Table 5: Arriving respondents by point of origin and direction

	Total		Directional distribution of arriving traffic			
			West		East	
	Count	Col %	Count	Col %	Count	Col %
Waialua	29	1.3%	28	2.0%	1	0.1%
Haleiwa	194	8.5%	185	13.2%	9	1.0%
Laniakea to Waimea bay	34	1.5%	30	2.1%	4	0.5%
Three Tables beach to Kawela Beach	275	12.1%	265	18.9%	10	1.2%
Kahuku	159	7.0%	26	1.9%	133	15.3%
Laie	210	9.3%	22	1.6%	188	21.6%
Hauula	80	3.5%	8	0.6%	72	8.3%
Kaaawa	14	0.6%	1	0.1%	13	1.5%
Windward	140	6.2%	25	1.8%	115	13.2%
East Honolulu	20	0.9%	15	1.1%	5	0.6%
Honolulu	709	31.2%	477	34.0%	232	26.7%
Central Oahu	159	7.0%	138	9.9%	21	2.4%
Leeward Oahu	139	6.1%	124	8.9%	15	1.7%
Other	108	4.8%	57	4.1%	51	5.9%
Total	2,270	100.0%	1,401	100.0%	869	100.0%

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Table 6: Departing respondents by destination and direction

	Total		Directional distribution of departing traffic			
			West		East	
	Count	Col %	Count	Col %	Count	Col %
Waialua	38	1.9%	37	3.1%	1	0.1%
Haleiwa	221	11.0%	208	17.5%	13	1.6%
Laniakea to Waimea bay	18	0.9%	18	1.5%		
Three Tables beach to Kawela Beach	242	12.1%	235	19.8%	7	0.9%
Kahuku	174	8.7%	19	1.6%	155	18.9%
Laie	234	11.7%	28	2.4%	206	25.1%
Hauula	55	2.7%	7	0.6%	48	5.9%
Kaaawa	18	0.9%			18	2.2%
Windward	126	6.3%	27	2.3%	99	12.1%
East Honolulu	19	0.9%	9	0.8%	10	1.2%
Honolulu	465	23.2%	300	25.3%	165	20.1%
Central Oahu	123	6.1%	109	9.2%	14	1.7%
Leeward Oahu	96	4.8%	81	6.8%	15	1.8%
Other	121	6.0%	77	6.5%	44	5.4%
Unknown	57	2.8%	32	2.7%	25	3.0%
Total	2,007	100.0%	1,187	100.0%	820	100.0%

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Table 7.1: Arriving respondents by point of origin and day part

			Start Time																							
			8am - 9am				9am - 10am				10am - 11am				11am - 12pm				12pm - 1pm				1pm - 2pm			
			Weekday vs Weekend				Weekday vs Weekend				Weekday vs Weekend				Weekday vs Weekend				Weekday vs Weekend				Weekday vs Weekend			
			Weekday		Weekend		Weekday		Weekend		Weekday		Weekend		Weekday		Weekend		Weekday		Weekend		Weekday		Weekend	
	Count	Col %	Count	Col %	Count	Col %	Count	Col %	Count	Col %	Count	Col %	Count	Col %	Count	Col %	Count	Col %	Count	Col %	Count	Col %	Count	Col %	Count	Col %
Waialua	30	1.3%	3	3.3%			3	3.2%	1	1.8%					4	2.5%			1	0.7%			1	0.6%	1	0.9%
Haleiwa	207	8.7%	4	4.4%	2	5.7%	4	4.2%	7	12.5%	9	4.6%	6	17.1%	12	7.5%	2	5.1%	15	9.9%	4	5.6%	15	8.4%	6	5.6%
Laniakea to Waimea bay	34	1.4%									1	0.5%			3	1.9%	1	2.6%	2	1.3%	2	2.8%			1	0.9%
Three Tables beach to Kawela Beach	294	12.3%	22	24.4%	7	20.0%	16	16.8%	10	17.9%	20	10.2%	2	5.7%	18	11.3%	4	10.3%	17	11.2%	14	19.4%	19	10.7%	9	8.3%
Kahuku	166	6.9%	7	7.8%			10	10.5%			13	6.6%	1	2.9%	13	8.1%	1	2.6%	14	9.2%	7	9.7%	15	8.4%	6	5.6%
Laie	216	9.0%	10	11.1%	5	14.3%	9	9.5%	5	8.9%	21	10.7%	4	11.4%	7	4.4%	5	12.8%	12	7.9%	7	9.7%	26	14.6%	9	8.3%
Hauula	84	3.5%	6	6.7%	4	11.4%	6	6.3%			6	3.1%	6	17.1%	3	1.9%	1	2.6%	6	3.9%			4	2.2%	4	3.7%
Kaaawa	14	0.6%	2	2.2%									1	2.9%	1	0.6%			1	0.7%	1	1.4%	1	0.6%	1	0.9%
Windward	142	5.9%	4	4.4%	5	14.3%	3	3.2%	3	5.4%	13	6.6%	2	5.7%	11	6.9%	5	12.8%	7	4.6%	5	6.9%	16	9.0%	12	11.1%
East Honolulu	19	0.8%	2	2.2%			1	1.1%	2	3.6%	3	1.5%			2	1.3%			1	0.7%			1	0.6%	1	0.9%
Honolulu	737	30.8%	13	14.4%	3	8.6%	19	20.0%	16	28.6%	59	30.1%	7	20.0%	58	36.3%	11	28.2%	52	34.2%	21	29.2%	56	31.5%	38	35.2%
Central Oahu	165	6.9%	8	8.9%	5	14.3%	9	9.5%	8	14.3%	26	13.3%	1	2.9%	10	6.3%	4	10.3%	3	2.0%	2	2.8%	10	5.6%	6	5.6%
Leeward Oahu	142	5.9%	8	8.9%	3	8.6%	7	7.4%	4	7.1%	14	7.1%	4	11.4%	11	6.9%	3	7.7%	12	7.9%	5	6.9%	8	4.5%	7	6.5%
Other	139	5.8%	1	1.1%	1	2.9%	8	8.4%			11	5.6%	1	2.9%	7	4.4%	2	5.1%	9	5.9%	4	5.6%	6	3.4%	7	6.5%
Total	2,389	100.0%	90	100.0%	35	100.0%	95	100.0%	56	100.0%	196	100.0%	35	100.0%	160	100.0%	39	100.0%	152	100.0%	72	100.0%	178	100.0%	108	100.0%

Table 7.2: Arriving respondents by point of origin and day part

	Start Time																							
	2pm - 3pm				3pm - 4pm				4pm - 5pm				5pm - 6pm				6pm - 7pm				7pm - 8pm			
	Weekday vs Weekend				Weekday vs Weekend				Weekday vs Weekend				Weekday vs Weekend				Weekday vs Weekend				Weekday vs Weekend			
	Weekday		Weekend		Weekday		Weekend		Weekday		Weekend		Weekday		Weekend		Weekday		Weekend		Weekday		Weekend	
	Count	Col %	Count	Col %	Count	Col %	Count	Col %	Count	Col %	Count	Col %	Count	Col %	Count	Col %	Count	Col %	Count	Col %	Count	Col %	Count	Col %
Waialua	3	1.6%	1	1.4%	2	1.0%	3	3.6%	1	0.9%	1	1.3%	1	1.0%	2	2.5%					2	3.3%		
Haleiwa	9	4.9%	8	10.8%	20	9.8%	7	8.4%	11	9.8%	6	7.5%	16	16.0%	5	6.2%	15	15.5%	4	7.3%	14	23.0%	6	14.6%
Laniakea to Waimea bay	5	2.7%	1	1.4%	3	1.5%	2	2.4%	2	1.8%	1	1.3%	2	2.0%	2	2.5%	1	1.0%	2	3.6%	2	3.3%	1	2.4%
Three Tables beach to Kawela Beach	21	11.4%	7	9.5%	20	9.8%	8	9.6%	10	8.9%	14	17.5%	14	14.0%	5	6.2%	16	16.5%	11	20.0%	3	4.9%	7	17.1%
Kahuku	17	9.2%	6	8.1%	15	7.4%	1	1.2%	8	7.1%	6	7.5%	8	8.0%	3	3.7%	6	6.2%	3	5.5%	4	6.6%	2	4.9%
Laie	12	6.5%	2	2.7%	20	9.8%	2	2.4%	10	8.9%	2	2.5%	11	11.0%	3	3.7%	13	13.4%	7	12.7%	10	16.4%	4	9.8%
Hauula	15	8.1%	3	4.1%	1	0.5%	1	1.2%	3	2.7%	2	2.5%	4	4.0%			2	2.1%	1	1.8%	3	4.9%	3	7.3%
Kaaawa	2	1.1%					1	1.2%					1	1.0%			1	1.0%			1	1.6%		
Windward	7	3.8%	4	5.4%	10	4.9%	6	7.2%	5	4.5%	2	2.5%	7	7.0%	5	6.2%	4	4.1%	3	5.5%	1	1.6%	2	4.9%
East Honolulu			1	1.4%	2	1.0%	1	1.2%			1	1.3%			1	1.2%								
Honolulu	65	35.1%	28	37.8%	76	37.3%	30	36.1%	36	32.1%	24	30.0%	23	23.0%	39	48.1%	26	26.8%	12	21.8%	17	27.9%	8	19.5%
Central Oahu	15	8.1%	3	4.1%	15	7.4%	5	6.0%	9	8.0%	7	8.8%	4	4.0%	5	6.2%	4	4.1%	4	7.3%	1	1.6%	1	2.4%
Leeward Oahu	7	3.8%	3	4.1%	8	3.9%	7	8.4%	8	7.1%	8	10.0%	3	3.0%	2	2.5%	3	3.1%	5	9.1%	1	1.6%	1	2.4%
Other	7	3.8%	7	9.5%	12	5.9%	9	10.8%	9	8.0%	6	7.5%	6	6.0%	9	11.1%	6	6.2%	3	5.5%	2	3.3%	6	14.6%
Total	185	100.0%	74	100.0%	204	100.0%	83	100.0%	112	100.0%	80	100.0%	100	100.0%	81	100.0%	97	100.0%	55	100.0%	61	100.0%	41	100.0%

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Table 8.1: Departing respondents by destination and day part

			Start Time																							
			8am - 9am				9am - 10am				10am - 11am				11am - 12pm				12pm - 1pm				1pm - 2pm			
			Weekday vs Weekend				Weekday vs Weekend				Weekday vs Weekend				Weekday vs Weekend				Weekday vs Weekend				Weekday vs Weekend			
			Weekday		Weekend		Weekday		Weekend		Weekday		Weekend		Weekday		Weekend		Weekday		Weekend		Weekday		Weekend	
	Count	Col %	Count	Col %	Count	Col %	Count	Col %	Count	Col %	Count	Col %	Count	Col %	Count	Col %	Count	Col %	Count	Col %	Count	Col %	Count	Col %	Count	Col %
Waialua	38	1.8%													3	1.8%			1	0.5%			3	1.3%		
Haleiwa	223	10.5%	7	8.0%	3	3.4%	6	5.2%	2	1.7%	11	7.5%			14	8.2%	2	1.2%	20	10.8%	4	2.2%	14	6.1%	4	1.7%
Laniakea to Waimea bay	19	0.9%			1	1.1%	1	0.9%							4	2.3%			2	1.1%						
Three Tables beach to Kawela Beach	257	12.1%	14	16.1%	4	4.6%	17	14.7%	2	1.7%	13	8.9%	1	0.7%	15	8.8%	4	2.3%	10	5.4%	7	3.8%	27	11.7%	1	0.4%
Kahuku	176	8.3%	3	3.4%			2	1.7%	1	0.9%	9	6.2%	2	1.4%	15	8.8%	2	1.2%	13	7.0%	5	2.7%	29	12.6%	3	1.3%
Laie	235	11.1%	6	6.9%	1	1.1%	8	6.9%	3	2.6%	10	6.8%	4	2.7%	16	9.4%	3	1.8%	13	7.0%	2	1.1%	17	7.4%	6	2.6%
Hauula	58	2.7%					1	0.9%			3	2.1%			2	1.2%	1	0.6%	2	1.1%	1	0.5%	6	2.6%		
Kaaawa	19	0.9%					1	0.9%			3	2.1%	1	0.7%					1	0.5%			1	0.4%		
Windward	132	6.2%	1	1.1%	3	3.4%	5	4.3%	2	1.7%	5	3.4%			9	5.3%	1	0.6%	5	2.7%	4	2.2%	13	5.6%	2	0.9%
East Honolulu	19	0.9%	3	3.4%			2	1.7%			1	0.7%			1	0.6%	1	0.6%	2	1.1%			1	0.4%	1	0.4%
Honolulu	475	22.4%	19	21.8%	3	3.4%	27	23.3%	7	6.0%	33	22.6%	3	2.1%	38	22.2%	6	3.5%	35	18.8%	10	5.4%	35	15.2%	15	6.5%
Central Oahu	126	5.9%	3	3.4%			3	2.6%	2	1.7%	7	4.8%	1	0.7%	7	4.1%			1	0.5%	3	1.6%	12	5.2%	4	1.7%
Leeward Oahu	99	4.7%	1	1.1%			1	0.9%			5	3.4%			4	2.3%	2	1.2%	10	5.4%	4	2.2%	9	3.9%	3	1.3%
Other	151	7.1%	8	9.2%	3	3.4%	13	11.2%	6	5.2%	20	13.7%	5	3.4%	11	6.4%	3	1.8%	11	5.9%	5	2.7%	7	3.0%	6	2.6%
Unknown	94	4.4%	3	3.4%	1	1.1%	3	2.6%	1	0.9%	7	4.8%	2	1.4%	7	4.1%			11	5.9%	4	2.2%	11	4.8%	1	0.4%
Total	2,121	100.0%	68	78.2%	19	21.8%	90	77.6%	26	22.4%	127	87.0%	19	13.0%	146	85.4%	25	14.6%	137	73.7%	49	26.3%	185	80.1%	46	19.9%

Table 8.2: Departing respondents by destination and day part

			Start Time																							
			2pm - 3pm				3pm - 4pm				4pm - 5pm				5pm - 6pm				6pm - 7pm				7pm - 8pm			
			Weekday vs Weekend				Weekday vs Weekend				Weekday vs Weekend				Weekday vs Weekend				Weekday vs Weekend				Weekday vs Weekend			
			Weekday		Weekend		Weekday		Weekend		Weekday		Weekend		Weekday		Weekend		Weekday		Weekend		Weekday		Weekend	
	Count	Col %	Count	Col %	Count	Col %	Count	Col %	Count	Col %	Count	Col %	Count	Col %	Count	Col %	Count	Col %	Count	Col %	Count	Col %	Count	Col %	Count	Col %
Waialua	1	0.4%			3	1.1%	1	0.4%	6	2.7%	3	1.3%	5	2.7%			4	2.6%	4	2.6%	3	3.1%	1	1.0%
Haleiwa	20	8.2%	8	3.3%	27	9.6%	6	2.1%	14	6.3%	6	2.7%	14	7.5%	2	1.1%	17	11.2%	3	2.0%	17	17.5%	2	2.1%
Laniakea to Waimea bay	2	0.8%			1	0.4%	3	1.1%	2	0.9%			1	0.5%			2	1.3%						
Three Tables beach to Kawela Beach	27	11.0%	3	1.2%	21	7.5%	4	1.4%	21	9.4%	10	4.5%	10	5.4%	9	4.8%	11	7.2%	12	7.9%	9	9.3%	5	5.2%
Kahuku	9	3.7%	4	1.6%	20	7.1%	5	1.8%	12	5.4%	12	5.4%	9	4.8%	1	0.5%	11	7.2%	2	1.3%	5	5.2%	2	2.1%
Laie	18	7.3%	6	2.4%	28	10.0%	9	3.2%	19	8.5%	8	3.6%	21	11.3%	10	5.4%	15	9.9%	1	0.7%	10	10.3%	1	1.0%
Hauula	2	0.8%	3	1.2%	7	2.5%	2	0.7%	9	4.0%	3	1.3%	2	1.1%	2	1.1%	5	3.3%	1	0.7%	3	3.1%	3	3.1%
Kaaawa	2	0.8%	2	0.8%	3	1.1%			2	0.9%	2	0.9%	1	0.5%										
Windward	7	2.9%	7	2.9%	12	4.3%	18	6.4%	2	0.9%	5	2.2%	16	8.6%	2	1.1%	5	3.3%	5	3.3%	2	2.1%	1	1.0%
East Honolulu	1	0.4%	1	0.4%	1	0.4%					1	0.4%			1	0.5%			1	0.7%	1	1.0%		
Honolulu	42	17.1%	26	10.6%	32	11.4%	25	8.9%	23	10.3%	21	9.4%	25	13.4%	11	5.9%	10	6.6%	16	10.5%	10	10.3%	3	3.1%
Central Oahu	11	4.5%	7	2.9%	7	2.5%	8	2.9%	15	6.7%	5	2.2%	7	3.8%	7	3.8%	6	3.9%	2	1.3%	7	7.2%	1	1.0%
Leeward Oahu	13	5.3%	4	1.6%	10	3.6%	7	2.5%	6	2.7%	5	2.2%	2	1.1%	7	3.8%	3	2.0%			2	2.1%	1	1.0%
Other	7	2.9%	6	2.4%	7	2.5%	2	0.7%	3	1.3%	3	1.3%	8	4.3%	6	3.2%	4	2.6%	3	2.0%	1	1.0%	3	3.1%
Unknown	5	2.0%	1	0.4%	8	2.9%	3	1.1%	2	0.9%	4	1.8%	6	3.2%	1	0.5%	7	4.6%	2	1.3%	3	3.1%	1	1.0%
Total	167	68.2%	78	31.8%	187	66.8%	93	33.2%	136	60.7%	88	39.3%	127	68.3%	59	31.7%	100	65.8%	52	34.2%	73	75.3%	24	24.7%

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Table 9: Arriving respondents by day part and direction

	Total		Directional distribution of arriving traffic			
			West		East	
	Count	Col %	Count	Col %	Count	Col %
8am - 9am	122	4.6%	79	4.9%	43	4.2%
9am - 10am	146	5.5%	99	6.1%	47	4.6%
10am - 11am	238	9.0%	142	8.8%	96	9.5%
11am - 12pm	202	7.7%	130	8.0%	72	7.1%
12pm - 1pm	223	8.5%	131	8.1%	92	9.1%
1pm - 2pm	306	11.6%	155	9.6%	151	14.9%
2pm - 3pm	302	11.5%	181	11.2%	121	11.9%
3pm - 4pm	320	12.1%	214	13.2%	106	10.5%
4pm - 5pm	242	9.2%	147	9.1%	95	9.4%
5pm - 6pm	226	8.6%	142	8.8%	84	8.3%
6pm - 7pm	184	7.0%	112	6.9%	72	7.1%
7pm - 8pm	123	4.7%	89	5.5%	34	3.4%
Total	2,634	100.0%	1,621	100.0%	1,013	100.0%

Table 10: Departing respondents by day part and direction

	Total		Directional distribution of departing traffic			
			West		East	
	Count	Col %	Count	Col %	Count	Col %
8am - 9am	100	4.1%	68	4.6%	32	3.3%
9am - 10am	142	5.8%	92	6.2%	50	5.1%
10am - 11am	182	7.4%	107	7.2%	75	7.6%
11am - 12pm	242	9.8%	157	10.6%	85	8.6%
12pm - 1pm	258	10.5%	148	10.0%	110	11.2%
1pm - 2pm	250	10.1%	144	9.7%	106	10.8%
2pm - 3pm	255	10.3%	155	10.5%	100	10.2%
3pm - 4pm	317	12.8%	175	11.8%	142	14.4%
4pm - 5pm	247	10.0%	147	9.9%	100	10.2%
5pm - 6pm	211	8.6%	116	7.8%	95	9.7%
6pm - 7pm	163	6.6%	110	7.4%	53	5.4%
7pm - 8pm	100	4.1%	64	4.3%	36	3.7%
Total	2,467	100.0%	1,483	100.0%	984	100.0%

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Table 11: Arriving respondents by point of origin by weekday vs. weekend

	Total		Weekday vs Weekend			
			Weekday		Weekend	
	Count	Col %	Count	Col %	Count	Col %
Waialua	30	1.3%	21	1.3%	9	1.2%
Haleiwa	207	8.6%	144	8.8%	63	8.2%
Laniakea to Waimea bay	34	1.4%	21	1.3%	13	1.7%
Three Tables beach to Kawela Beach	295	12.3%	196	12.0%	99	13.0%
Kahuku	167	7.0%	131	8.0%	36	4.7%
Laie	216	9.0%	161	9.8%	55	7.2%
Hauula	84	3.5%	59	3.6%	25	3.3%
Kaaawa	14	0.6%	10	0.6%	4	0.5%
Windward	142	5.9%	88	5.4%	54	7.1%
East Honolulu	20	0.8%	12	0.7%	8	1.0%
Honolulu	743	31.0%	504	30.8%	239	31.3%
Central Oahu	165	6.9%	114	7.0%	51	6.7%
Leeward Oahu	142	5.9%	90	5.5%	52	6.8%
Other	140	5.8%	84	5.1%	56	7.3%
Total	2,399	100.0%	1,635	100.0%	764	100.0%

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Table 12: Departing respondents by point of origin by weekday vs. weekend

	Total		Weekday vs Weekend			
			Weekday		Weekend	
	Count	Col %	Count	Col %	Count	Col %
Waialua	38	1.8%	29	1.9%	9	1.5%
Haleiwa	225	10.6%	183	11.8%	42	7.2%
Laniakea to Waimea bay	19	0.9%	15	1.0%	4	0.7%
Three Tables beach to Kawela Beach	258	12.1%	195	12.6%	63	10.8%
Kahuku	177	8.3%	138	8.9%	39	6.7%
Laie	236	11.1%	182	11.7%	54	9.3%
Hauula	59	2.8%	43	2.8%	16	2.8%
Kaaawa	19	0.9%	14	0.9%	5	0.9%
Windward	132	6.2%	82	5.3%	50	8.6%
East Honolulu	19	0.9%	13	0.8%	6	1.0%
Honolulu	477	22.4%	330	21.3%	147	25.3%
Central Oahu	126	5.9%	86	5.6%	40	6.9%
Leeward Oahu	100	4.7%	66	4.3%	34	5.9%
Other	151	7.1%	100	6.5%	51	8.8%
Unknown	94	4.4%	73	4.7%	21	3.6%
Total	2,130	100.0%	1,549	100.0%	581	100.0%

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Table 13: Total arrivals by direction and weekday vs. weekend

	Total		Directional distribution of arriving traffic			
			West		East	
	Count	Col %	Count	Col %	Count	Col %
Weekday	1,638	61.9%	989	60.7%	649	63.8%
Weekend	1,008	38.1%	640	39.3%	368	36.2%
Total	2,646	100.0%	1,629	100.0%	1,017	100.0%

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Table 14: Total departures by direction and weekday vs. weekend

	Total		Directional distribution of departing traffic			
			West		East	
	Count	Col %	Count	Col %	Count	Col %
Weekday	1,626	65.6%	966	64.9%	660	66.7%
Weekend	851	34.4%	522	35.1%	329	33.3%
Total	2,477	100.0%	1,488	100.0%	989	100.0%

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Table 15: Arriving respondents by point of origin – hotel vs. condominium

	Total		Hotel guest vs. Condo guest/resident			
			Hotel guest		Condo guest/resident	
	Count	Col %	Count	Col %	Count	Col %
Waialua	5	0.6%	2	0.4%	3	0.9%
Haleiwa	82	9.3%	53	9.5%	29	8.9%
Laniakea to Waimea bay	20	2.3%	12	2.2%	8	2.5%
Three Tables beach to Kawela Beach	100	11.3%	52	9.3%	48	14.8%
Kahuku	74	8.4%	33	5.9%	41	12.6%
Laie	89	10.1%	46	8.2%	43	13.2%
Hauula	12	1.4%	5	0.9%	7	2.2%
Kaaawa	6	0.7%	5	0.9%	1	0.3%
Windward	38	4.3%	19	3.4%	19	5.8%
East Honolulu	6	0.7%	4	0.7%	2	0.6%
Honolulu	277	31.4%	227	40.7%	50	15.4%
Central Oahu	40	4.5%	24	4.3%	16	4.9%
Leeward Oahu	28	3.2%	11	2.0%	17	5.2%
Other	106	12.0%	65	11.6%	41	12.6%
Total	883	100.0%	558	100.0%	325	100.0%

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Table 16: Departing respondents by point of origin – hotel vs. condominium

	Total		Hotel guest vs. Condo guest/resident			
	Count	Col %	Hotel guest		Condo guest/resident	
			Count	Col %	Count	Col %
Waialua	4	0.4%	1	0.2%	3	1.0%
Haleiwa	105	11.4%	80	13.1%	25	8.1%
Laniakea to Waimea bay	8	0.9%	5	0.8%	3	1.0%
Three Tables beach to Kawela Beach	111	12.1%	64	10.5%	47	15.3%
Kahuku	59	6.4%	29	4.7%	30	9.8%
Laie	112	12.2%	72	11.8%	40	13.0%
Hauula	12	1.3%	4	0.7%	8	2.6%
Kaaawa	5	0.5%	4	0.7%	1	0.3%
Windward	38	4.1%	19	3.1%	19	6.2%
East Honolulu	4	0.4%	2	0.3%	2	0.7%
Honolulu	197	21.5%	176	28.8%	21	6.8%
Central Oahu	40	4.4%	23	3.8%	17	5.5%
Leeward Oahu	22	2.4%	18	2.9%	4	1.3%
Other	127	13.8%	81	13.3%	46	15.0%
Unknown	74	8.1%	33	5.4%	41	13.4%
Total	918	100.0%	611	100.0%	307	100.0%

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Table 17: Respondents traveling west who left and returned to Turtle Bay same day

	Count	Col %
Turtle Bay	6	1.6%
Three Tables to Kawela Beach	70	19.1%
Laniakea to Waimea	76	20.7%
Haleiwa	62	16.9%
Waialua	2	0.5%
Honolulu	46	12.5%
Central Oahu	22	6.0%
Leeward Oahu	6	1.6%
Other	77	21.0%
Total	367	100.0%

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Table 18: Respondents traveling east who left and returned to Turtle Bay same day

	Count	Col %
Kahuku	48	19.8%
Laie	86	35.5%
Hauula	3	1.2%
Kaaawa	5	2.1%
Windward	13	5.4%
East Honolulu	4	1.7%
Honolulu	17	7.0%
Central Oahu	1	0.4%
Leeward Oahu	3	1.2%
Other	58	24.0%
Total	242	100.0%

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Table 19: Final Destination of respondents traveling west

	Departing	Final Destination
Turtle bay	988	-
Three Tables to Kawela Beach	753	235
Laniakea to Waimea	735	18
Haleiwa	527	208
Waialua	490	37
Honolulu	190	300
Central Oahu	81	109
Leeward Oahu	0	81

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Table 20: Final Destination of respondents traveling east

	Departing	Final Destination
Turtle Bay	730	-
Kahuku	575	155
Laie	369	206
Hauula	321	48
Kaaawa	303	18
Windward	204	99
East Honolulu	194	10
Honolulu	29	165
Central Oahu	15	14
Leeward Oahu	0	15

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APPENDIX

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Appendix A: Survey Instrument

	Time Started	Status	Direction from/To		Starting Point	Final Destination	Planned Stops	Time left Origin	Refused	Cars missed
			Haleiwa	Laie						
1			☐	☐					☐	
2			☐	☐					☐	
3			☐	☐					☐	
4			☐	☐					☐	
5			☐	☐					☐	
6			☐	☐					☐	
7			☐	☐					☐	
8			☐	☐					☐	
9			☐	☐					☐	
10			☐	☐					☐	
11			☐	☐					☐	
12			☐	☐					☐	
13			☐	☐					☐	
14			☐	☐					☐	
15			☐	☐					☐	

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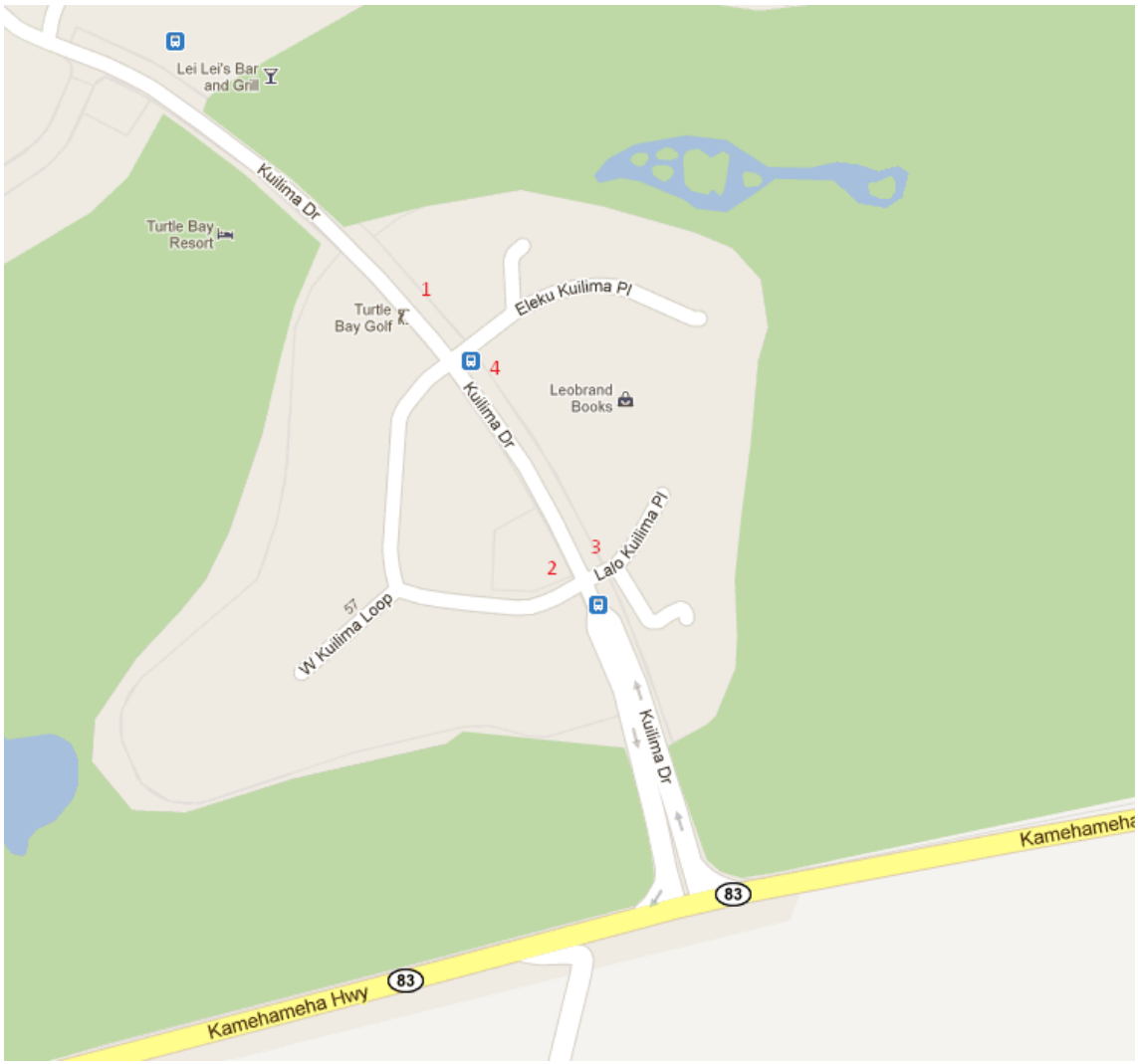
Appendix B: Map

There was a total of four survey locations (marked in red), but only three locations were being fielded at any given time. Survey station 1 which is the entrance to Turtle Bay Resort guests and golf course was always fielded at, while interviewers rotated every two hours between stations 2, 3, and 4 (entrances to Kuilima Estates).

Figure 1: Turtle Bay fielding location



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APPENDIX L:

CULTURAL AND NATURAL RESOURCES MANAGEMENT PLAN

L

TURTLE BAY RESORT
CULTURAL MANAGEMENT PLAN

Executive Summary

Introduction: The guidelines and procedures outlined in the Turtle Bay Resort (TBR) Cultural Management Plan (CMP) are to be used to ensure the protection of historic properties (which includes human remains) discovered at TBR, including during planning, construction, operations and maintenance. These procedures have been prepared to plan for and respond to such contingencies in a culturally appropriate manner, as well as to facilitate the archaeological monitoring and the timely completion of TBR related activities.

The major components of this CMP include:

- Process to be followed in the event of an inadvertent discovery of human remains;
- Roles and responsibilities for TBR, Ku‘iwalu and the Archaeological Consultant;
- A call-out list for the project(s) with names, titles, phone and/or cellular numbers of everyone that may need to be contacted.

If historic properties are discovered, the CMP should facilitate rapid responses for taking prudent action to resolve the incident as soon as possible including:

1. Identification, determination of jurisdiction and notification;
2. Assisting the relevant authorities with their investigations;
3. Monitoring the situation and appropriately informing all of those affected;
4. Acknowledging the various responsibilities;
5. Implement restoration action as necessary; and
6. Documentation of the entire incident.

Project Requirements: TBR is required to comply with Chapter 6E, Hawai‘i Revised Statutes, and the applicable administrative rules. An Archaeological Monitoring Plan (AMP) was prepared for portion of the Alpha Road Construction within the Turtle Bay Resort Development Area dated April 2006. Although the AMP may not cover the entire TBR project site, the Archaeological Monitoring Provisions provides adequate guidelines for all subsurface activities.

Cultural Management Plan

1.0 Purpose: The guidelines and procedures outlined in this CMP will be used to plan for, report and respond to any inadvertent discovery of historic properties, including human remains (incidents) on all activities related to TBR.

2.0 Objectives:

- Enable those involved to respond in a timely and culturally appropriate manner;
- Maintain TBR's credibility and minimize negative public and government agency's reaction by effectively resolving the incident;
- Minimize work stoppage;
- Minimize liability exposure to TBR in compliance with laws and regulations; and
- Human remains must be accorded full dignity and respect and if at all possible, burial places should not be disturbed. If it is not feasible to protect a burial from future construction activities, consultation with appropriate parties for the culturally appropriate treatment of the human remains shall be a priority consideration.

3.0 Archaeological Specifications:

- There shall be an on-site archaeological monitor during all ground disturbance activities, unless otherwise amended by TBR's Project Manager in consultation with the State Historic Preservation Division (SHPD); and
- Any other SHPD requirements.

4.0 Incident in Progress:

- *TBR's Project Manager's Responsibilities:*
  - Project Manager (PM) will be kept informed of all potential subsurface activities or construction and operations related activities within TBR, in particular, activities within the shoreline or beach areas, to ensure compliance with the CMP and applicable regulations;
  - Contact and retain the services of an archaeological monitor for all appropriate subsurface activity. If the PM is uncertain whether to have an on-site archaeological monitor, than he will consult with the Archaeological Consultant (AC) or Ku'iwalu for assistance;
  - Immediately contact the AC upon the discovery of historic properties, specifically the discovery of human remains if the archaeologist is not onsite;
  - As the owner's representative the PM will coordinate with the owner, TBR personnel, AC and Ku'iwalu on all relevant matters related to the incident;
  - Immediately notify the call out list when alerted to a possible incident; and
  - Coordinate with the owner, TBR, and AC when work may resume.

- *TBR personnel (for ongoing maintenance or operations actions) or Contractor's (for all other construction related activities)Responsibilities:*

- Confer with the PM on all excavation or installation of permanent equipment within the shoreline or beach area to ensure compliance with applicable regulations, i.e., conservation district use, special management area, etc.;
- Cease all work in the affected area upon the discovery of potential historic properties, including human remains and said area shall not be disturbed until it is inspected by the AC;
- Immediately notify the PM regarding the incident;
- Stake or flag off affected area to prevent additional disturbances;
- Coordinate restoration efforts with AC as necessary; and
- Resume work upon notice by the PM.

- *Archaeological Consultant's (AC) Responsibilities*:
  - Respond within 24 hours or sooner from notification of the discovery of human remains;
  - Stop construction activity when historic properties, including human remains, are found although the AC may redirect construction activity to another area;
  - Determine jurisdiction of the inadvertent discovery (human, over 50 years, and ethnicity);
  - Make all required notifications when human remains have been discovered (SHPD, Honolulu Police Department (HPD), O'ahu Island Burial Council (OIBC));
  - Notify the PM when work may resume;
  - Provide adequate information and summary of the incident regarding the discovery of historic properties, including human remains to Ku'iwalu who will prepare talking points on the incident; and
  - Comply with all requirements of SHPD or applicable regulations, including all appropriate documentation.

- *Ku'iwalu's Responsibilities:*
  - Coordinate and facilitate resolution of the incident and handle communications with the public including and appropriate regulatory agencies (including SHPD) when notified of an incident;
  - If human remains are involved, contact the Kahuku Burial Committee (KBC) members or any recognized lineal or cultural descendants of the discovery of human remains;
  - Consult with interested parties in the preparation and distribution of information and statements to the community, news media, and other groups, as required including draft and distribute talking points regarding the incident,
  - Provide incident follow-up and project status to the OIBC, SHPD, KBC, and other relevant organizations and or individuals, as required; and
  - Evaluate efficacy of the CMP and update as needed.

APPROVED BY: _____ DATE: AUG 7, 2012

DREW STOTESBURY
ceo | turtle bay resort | o'ahu

CALL-OUT LIST

State Historic Preservation Division:	
Pua Aiu, Administrator	(808) 692-8015 (on O‘ahu)
HPD	911
TBR:	
Ralph Makaiau (PM)	(808) 447-6954 (o) / (808) 478-6548 (m)
Drew Stotesbury	(808) 352-4362 (m)
Scott McCormack	(808) 447-6956 (o) / (808) 755-5933 (m)
Danna Holck	(808) 293-6040 (o) / (808) 226-4034 (m)
Matt Hall (If Golf Courses involved)	(808) 795-3615 (o) / (808) 294-1699 (m)
Ku‘iwalu:	
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APPENDIX K:

NOISE IMPACT ANALYSIS

K

ACOUSTIC STUDY FOR THE TURTLE BAY RESORT MASTER PLAN KAHUKU, OAHU, HAWAII

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AUGUST 2012

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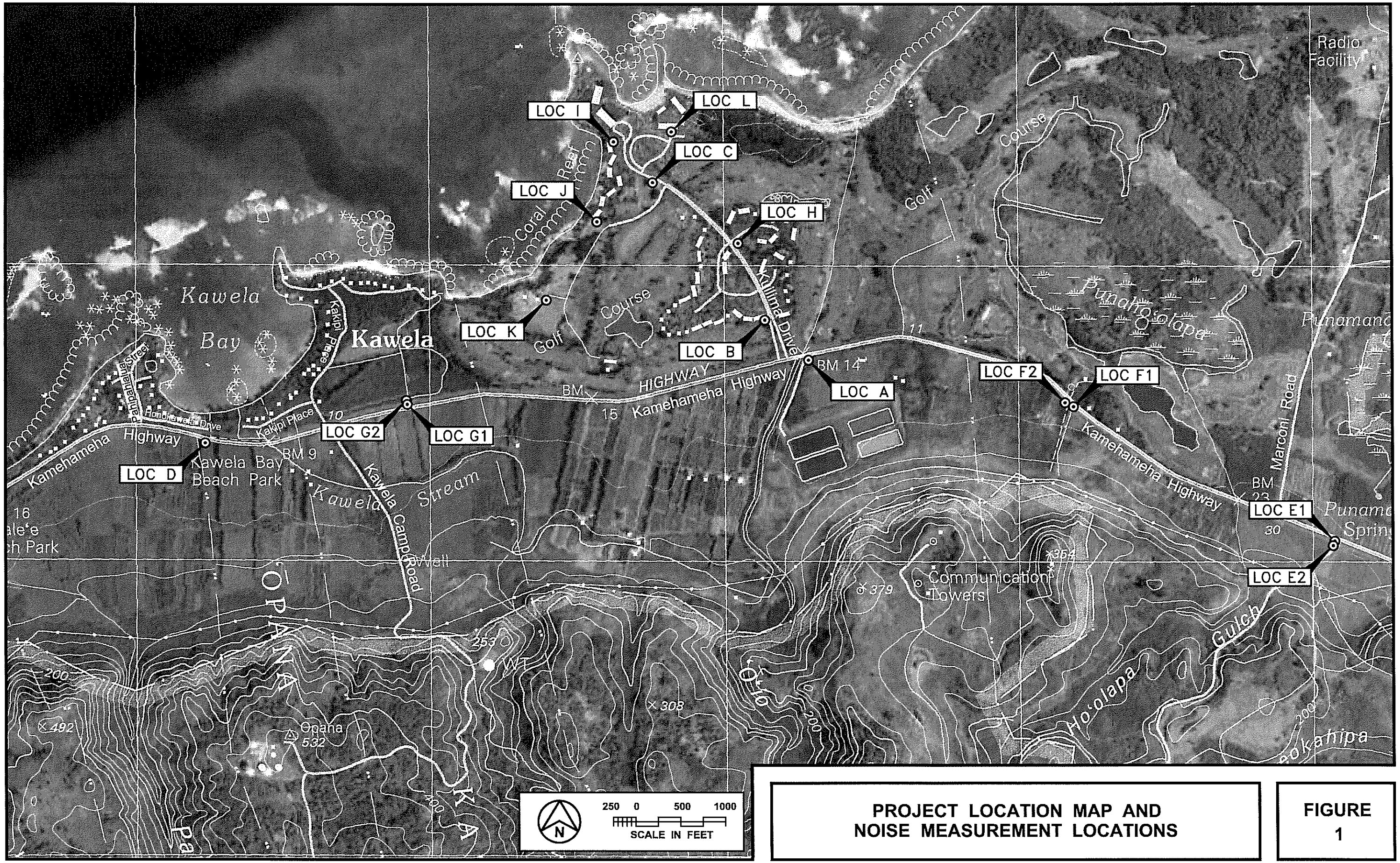
CHAPTER I. SUMMARY

The existing and future traffic noise levels in the vicinity of the proposed Master Plan for the Turtle Bay Resort at Kawela Bay, Oahu were evaluated for their potential impact on present and future noise sensitive areas. Figure 1 depicts the location of the project site. The future traffic noise levels along the primary access roadways to the project were calculated for the year 2025.

Along the existing Kamehameha Highway, traffic noise levels were expected to increase by 1.2 to 4.3 DNL (Day-Night Average Sound Level) between CY 2011 and CY 2025 as a result of both project and non-project traffic. Traffic noise increases due to project traffic were predicted to range from 0.2 to 3.3 DNL which were greater than the range of the noise increases caused by non-project traffic (1.0 to 1.2 DNL) on Kamehameha Highway. These increases in traffic noise levels associated with project traffic were considered to be moderate to high.

Future traffic noise levels at existing and planned noise sensitive locations along Kamehameha Highway in the project environs were expected to exceed 65 DNL without noise mitigation measures. Existing residences west of Kawela Bay and two existing residences located approximately 0.7 miles east of Kuilima Drive were predicted to experience future traffic noise levels greater than 65 DNL. Future project residents located along Kamehameha Highway may be impacted by traffic noise if adequate setback distances are not provided from the highway or if sound attenuation walls or berms are not included in the project. Due to the relatively short setback distances of existing residences west of Kawela Bay, approximately thirteen of these residences currently experience traffic noise levels greater than 65 DNL. By 2025, an additional five residences were predicted to experience traffic noise levels greater than 65 DNL.

Unavoidable, but temporary, noise impacts may occur during the construction of the proposed project. Because construction activities may be audible at the developed properties of Kuilima Estates and Ocean Villas, the resort's hotel and spa buildings, and at single family residences along Kamehameha Highway, the acoustic environment from construction of the project may be degraded during periods of construction. Mitigation measures to reduce construction noise to inaudible levels will not be practical in all cases. For this reason, the use of quiet equipment and construction curfew periods as required under the State Department of Health noise regulations are recommended to minimize construction noise impacts.



PROJECT LOCATION MAP AND NOISE MEASUREMENT LOCATIONS

FIGURE 1

CHAPTER II. PURPOSE

The objectives of this study were to describe the existing and future noise environment in the environs of the proposed Master Plan for the Turtle Bay Resort Project at Kawela Bay on the island of Oahu. Traffic noise level increases and impacts associated with the proposed Master Plan were to be determined within the project site as well as along the public roadways expected to service the project traffic. A specific objective was to determine the future traffic noise level increases associated with both project and non-project traffic, and the potential noise impacts associated with these increases. Assessments of possible impacts from short term construction noise at the project site were also included in the noise study objectives. Recommendations for minimizing these noise impacts were also to be provided as required.

CHAPTER III. NOISE DESCRIPTORS AND THEIR RELATIONSHIP TO LAND USE COMPATIBILITY

The noise descriptor currently used by federal agencies to assess environmental noise is the Day-Night Average Sound Level (DNL or Ldn). This descriptor incorporates a 24-hour average of instantaneous A-Weighted sound levels as read on a standard Sound Level Meter. The maximum A-Weighted sound level occurring while a noise source such as a heavy truck or aircraft is moving past a listener (i.e., the maximum sound level from a "single event") is referred to as the "Lmax value". The mathematical product (or integral) of the instantaneous sound level times the duration of the event is known as the "Sound Exposure Level", or Lse, which is analogous to the energy of the time-varying sound levels associated with a single event.

The DNL values represent the average noise during a typical day of the year. DNL exposure levels of 55 or less are typical of quiet rural or suburban areas. DNL exposure levels of 55 to 65 are typical of urbanized areas with medium to high levels of activity and street traffic. DNL exposure levels above 65 are representative of densely developed urban areas and areas fronting high volume roadways.

By definition, the minimum averaging period for the DNL descriptor is 24 hours. Additionally, sound levels which occur during the nighttime hours of 10:00 PM to 7:00 AM are increased by 10 decibels (dB) prior to computing the 24-hour average by the DNL descriptor. Because of the averaging used, DNL values in urbanized areas typically range between 50 and 75 DNL. In comparison, the typical range of intermittent noise events may have maximum Sound Level Meter readings between 75 and 105 dBA. A more complete list of noise descriptors is provided in Appendix B to this report. In Appendix B, the Ldn descriptor symbol is used in place of the DNL descriptor symbol.

Table 1, extracted from Reference 1, categorizes the various DNL levels of outdoor noise exposure with severity classifications. Figure 2, extracted from Reference 2, presents suggested land use compatibility guidelines for residential and nonresidential land uses. A general consensus among federal agencies has developed whereby residential housing development is considered acceptable in areas where exterior noise does not exceed 65 DNL. This value of 65 DNL is used as a federal regulatory threshold for determining the necessity for special noise abatement measures when applications for federal funding assistance are made.

As a general rule, noise levels of 55 DNL or less occur in rural areas, or in areas which are removed from high volume roadways. In urbanized areas which are shielded from high volume streets, DNL levels generally range from 55 to 65 DNL, and are usually controlled by motor vehicle traffic noise. Residences which front major roadways are generally exposed to levels of 65 DNL, and as high as 75 DNL when the roadway is a high speed freeway. Due to noise shielding effects from intervening

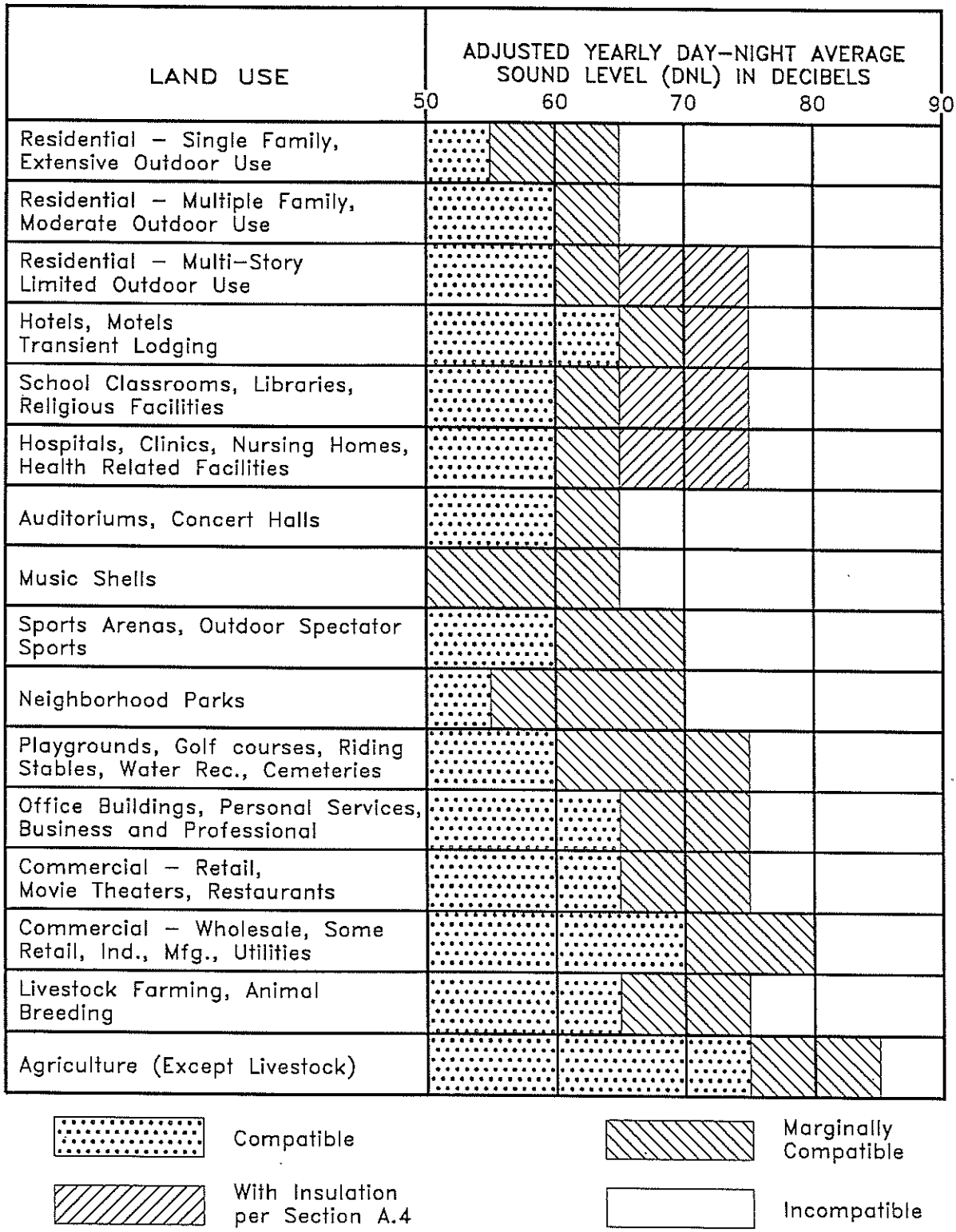
TABLE 1

EXTERIOR NOISE EXPOSURE CLASSIFICATION (RESIDENTIAL LAND USE)

NOISE EXPOSURE CLASS	DAY–NIGHT SOUND LEVEL	EQUIVALENT SOUND LEVEL	FEDERAL (1) STANDARD
Minimal Exposure	Not Exceeding 55 DNL	Not Exceeding 55 Leq	Unconditionally Acceptable
Moderate Exposure	Above 55 DNL But Not Above 65 DNL	Above 55 Leq But Not Above 65 Leq	Acceptable(2)
Significant Exposure	Above 65 DNL But Not Above 75 DNL	Above 65 Leq But Not Above 75 Leq	Normally Unacceptable
Severe Exposure	Above 75 DNL	Above 75 Leq	Unacceptable

Notes: (1) Federal Housing Administration, Veterans Administration, Department of Defense, and Department of Transportation.

(2) FHWA uses the Leq instead of the Ldn descriptor. For planning purposes, both are equivalent if: (a) heavy trucks do not exceed 10 percent of total traffic flow in vehicles per 24 hours, and (b) traffic between 10:00 PM and 7:00 AM does not exceed 15 percent of average daily traffic flow in vehicles per 24 hours. The noise mitigation threshold used by FHWA for residences is 67 Leq.



LAND USE COMPATIBILITY WITH YEARLY AVERAGE DAY–NIGHT AVERAGE SOUND LEVEL (DNL) AT A SITE FOR BUILDINGS AS COMMONLY CONSTRUCTED.
(Source: American National Standards Institute S12.9–1998/Part 5)

FIGURE 2

structures, interior lots are usually exposed to 3 to 10 DNL lower noise levels than the front lots which are not shielded from the traffic noise.

For the purposes of determining noise acceptability for funding assistance from federal agencies, an exterior noise level of 65 DNL or lower is considered acceptable. These federal agencies include the Federal Aviation Administration (FAA), Department of Defense (DOD); Federal Housing Administration, Housing and Urban Development (FHA/HUD), and Veterans Administration (VA). This standard is applied nationally (see Reference 3), including Hawaii.

Because of our open-living conditions, the predominant use of naturally ventilated dwellings, and the relatively low exterior-to-interior sound attenuation afforded by these naturally ventilated structures, an exterior noise level of 65 DNL does not eliminate all risks of noise impacts. Because of these factors, a lower level of 55 DNL is considered as the "Unconditionally Acceptable" (or "Near-Zero Risk") level of exterior noise (see Reference 4). For typical, naturally ventilated structures in Hawaii, an exterior noise level of 55 DNL results in an interior level of approximately 45 DNL, which is considered to be the "Unconditionally Acceptable" (or "Near-Zero Risk") level of interior noise. However, after considering the cost and feasibility of applying the lower level of 55 DNL, government agencies such as FHA/HUD and VA have selected 65 DNL as a more appropriate regulatory standard.

For commercial, industrial, and other non-noise sensitive land uses, exterior noise levels as high as 75 DNL are generally considered acceptable. Exceptions to this occur when naturally ventilated office and other commercial establishments are exposed to exterior levels which exceed 65 DNL.

In the State of Hawaii, the State Department of Health (DOH) regulates noise from on-site activities. State DOH noise regulations are expressed in maximum allowable property line noise limits rather than DNL (see Reference 5). The noise limits apply on all islands of the State, including Oahu. Although they are not directly comparable to noise criteria expressed in DNL, State DOH noise limits for preservation/residential, apartment/commercial, and agricultural/industrial lands equate to approximately 55, 60, and 76 DNL, respectively.

Because the proposed project site is located on lands designated for single family and multifamily residential, commercial, and agricultural uses, various DOH noise limits would be applicable along the lot boundary lines or receptor locations for any stationary machinery, or equipment related to commercial or construction activities. These property line limits are 60 dBA and 50 dBA during the daytime and nighttime periods, respectively, for commercial lots or receptors. For multifamily or apartment use, the State DOH limits are also 60 dBA and 50 dBA during the daytime and nighttime periods, respectively. For single family residential and public facility uses, the State DOH limits are 55 dBA and 45 dBA during the daytime and nighttime periods, respectively. For agricultural uses, the State DOH limit is 70 dBA during both the daytime and nighttime periods. These noise limits cannot be exceeded for more than 2

minutes in any 20-minute time period under the State DOH noise regulations. The State DOH noise regulations do not apply to aircraft or motor vehicles.

CHAPTER IV. GENERAL STUDY METHODOLOGY

Existing traffic and background ambient noise levels were measured at fifteen locations in the project environs to provide a basis for developing the traffic noise contours along Kamehameha Highway; and for determining the existing background ambient noise levels in the project area. The locations of the measurement sites are shown in Figure 1. Noise measurements were performed during February 2012. The traffic noise measurement results, and their comparisons with computer model predictions of existing traffic noise levels are summarized in Table 2. The results of the traffic noise measurements were compared with calculations of existing traffic noise levels to validate the computer model used.

Traffic noise calculations for the existing conditions as well as noise predictions for the future conditions with and without the project were performed using the Federal Highway Administration (FHWA) Noise Prediction Model (Reference 6). Traffic data entered into the noise prediction model were: hourly traffic volumes, average vehicle speeds, estimates of traffic mix, and loose soil propagation loss factor. The traffic assignments for the project (Reference 7) and Hawaii State Department of Transportation counts on Kamehameha Highway (Reference 8) were the primary sources of data inputs to the model.

For existing and future traffic, it was assumed that the average noise levels, or Leq(h), during the weekday PM peak hour were 0.3 dB greater than the weekday 24-hour DNL along any roadway segment in the project environs. This assumption was based on computations of both the weekday and weekend day hourly Leq's and the 24-hour DNL's of traffic noise on Kamehameha Highway and Kuilima Drive (see Figures 3 through 5). Because the weekend peak hour Leq(h) was slightly higher than the weekday PM peak hour Leq(h), the weekly, 7-day average DNL value was determined to be 0.1 to 0.3 dB higher than the 5-day, weekday DNL value. Therefore, the weekly, 7-day average DNL values were assumed be equal to the weekday PM peak hour Leq's in all calculations and modeling.

Traffic noise calculations for both the existing and future conditions in the project environs were developed for ground level receptors without the benefit of shielding effects. Traffic assignments with and without the project were obtained from the project's traffic turning movements (Reference 7). The forecasted increases in traffic noise levels over existing levels were calculated for both scenarios, and noise impact risks evaluated. The relative contributions of non-project and project related traffic to the total noise levels were also calculated, and an evaluation was made of possible traffic noise impacts resulting from the project.

Evaluations of the potential noise impacts associated with the four Master Plan alternatives (see Figures 6 through 9) for Turtle Bay Resort were provided, with all evaluations referenced to the Proposed Action shown in Figure 6. These evaluations

TABLE 2

TRAFFIC AND BACKGROUND NOISE MEASUREMENT RESULTS

LOCATION	Time of Day (HRS)	Ave. Speed (MPH)	Hourly Traffic Volume AUTO	M.TRUCK	H.TRUCK	Measured Leq (dB)	Predicted Leq (dB)
A. 50 FT from the center-line of Kamehameha Hwy. (2/09/12)	1050 TO 1150	45	478	25	14	66.5	66.5
B. 57 FT from the center-line of Kuilima Drive (2/09/12)	1059 TO 1159	25	272	7	7	56.9	57.3
C. 50 FT from the center-line of Kuilima Drive (2/09/12)	1252 TO 1352	25	209	2	8	56.6	56.6
D 50 FT from the center-line of Kamehameha Hwy. (2/09/12)	1500 TO 1600	55	709	5	5	70.5 (w siren) 68.6 (wo siren)	68.0
D 50 FT from the center-line of Kamehameha Hwy. (2/10/12)	0700 TO 0800	55	427	10	7	68.1	66.6
E1. 50 FT from the center-line of Kamehameha Hwy. (2/10/12)	0940 TO 1040	55	364	5	3	69.1	69.3

TABLE 2 (CONTINUED)

TRAFFIC AND BACKGROUND NOISE MEASUREMENT RESULTS

LOCATION	Time of Day (HRS)	Ave. Speed (MPH)	Hourly Traffic Volume AUTO	M.TRUCK	H.TRUCK	Measured Leq (dB)	Predicted Leq (dB)
E2. 100 FT from the center-line of Kamehameha Hwy. (2/10/12)	0940 TO 1040	55	364	5	3	62.8	62.6
F1. 50 FT from the center-line of Kamehameha Hwy. (2/10/12)	1056 TO 1156	55	505	13	7	67.5	67.2
F2. 95 FT from the center-line of Kamehameha Hwy. (2/10/12)	1056 TO 1156	55	505	13	7	60.2	62.0
F1. 50 FT from the center-line of Kamehameha Hwy. (2/10/12)	1454 TO 1554	55	814	6	8	69.9	68.7
F2. 95 FT from the center-line of Kamehameha Hwy. (2/10/12)	1454 TO 1554	55	814	6	8	63.3	63.7
G1. 50 FT from the center-line of Kamehameha Hwy. (2/10/12)	1613 TO 1713	55	753	6	6	68.0	68.3

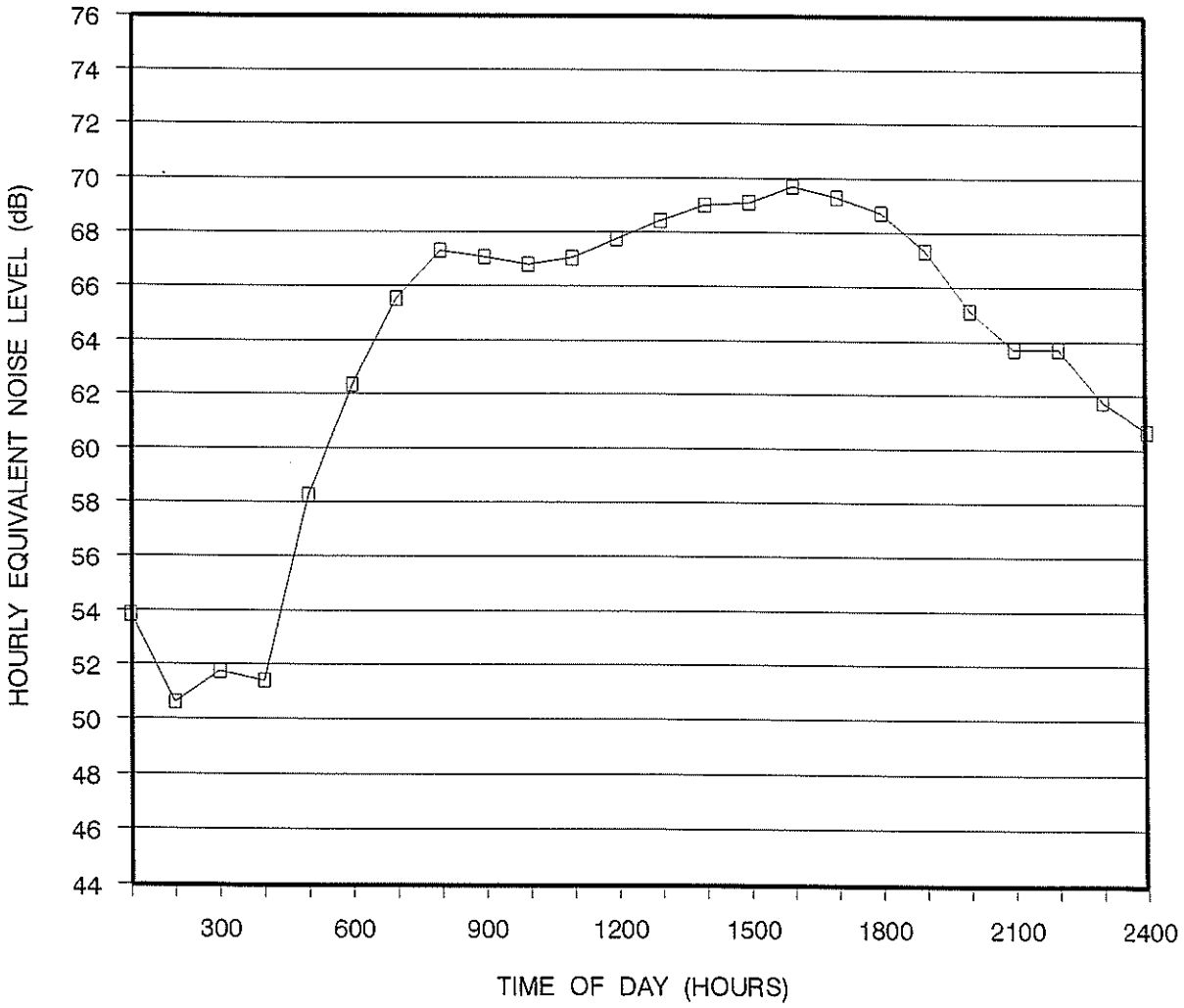
TABLE 2 (CONTINUED)

TRAFFIC AND BACKGROUND NOISE MEASUREMENT RESULTS

LOCATION	Time of Day (HRS)	Ave. Speed (MPH)	Hourly Traffic Volume AUTO	M.TRUCK	H.TRUCK	Measured Leq (dB)	Predicted Leq (dB)
G2. 100 FT from the center-line of Kamehameha Hwy. (2/10/12)	1613 TO 1713	55	753	6	6	60.9	61.6
H. On Kuilima Dr. at Eleku Kuilima Place (2/11/12)	0414 TO 0430	N/A	N/A	N/A	N/A	45.3	N/A
I. At Hotel Beach Cottage; east end. (2/11/12)	0807 TO 0837	N/A	N/A	N/A	N/A	54.1	N/A
J. At Hotel Beach Cottage west end with helo noise. (2/11/12)	0845 TO 0857	N/A	N/A	N/A	N/A	61.2	N/A
K. At Horse Stables (2/11/12)	0912 TO 0922	N/A	N/A	N/A	N/A	52.3	N/A
L. At Ocean Villas. (2/11/12)	0945 TO 1000	N/A	N/A	N/A	N/A	52.4	N/A

FIGURE 3

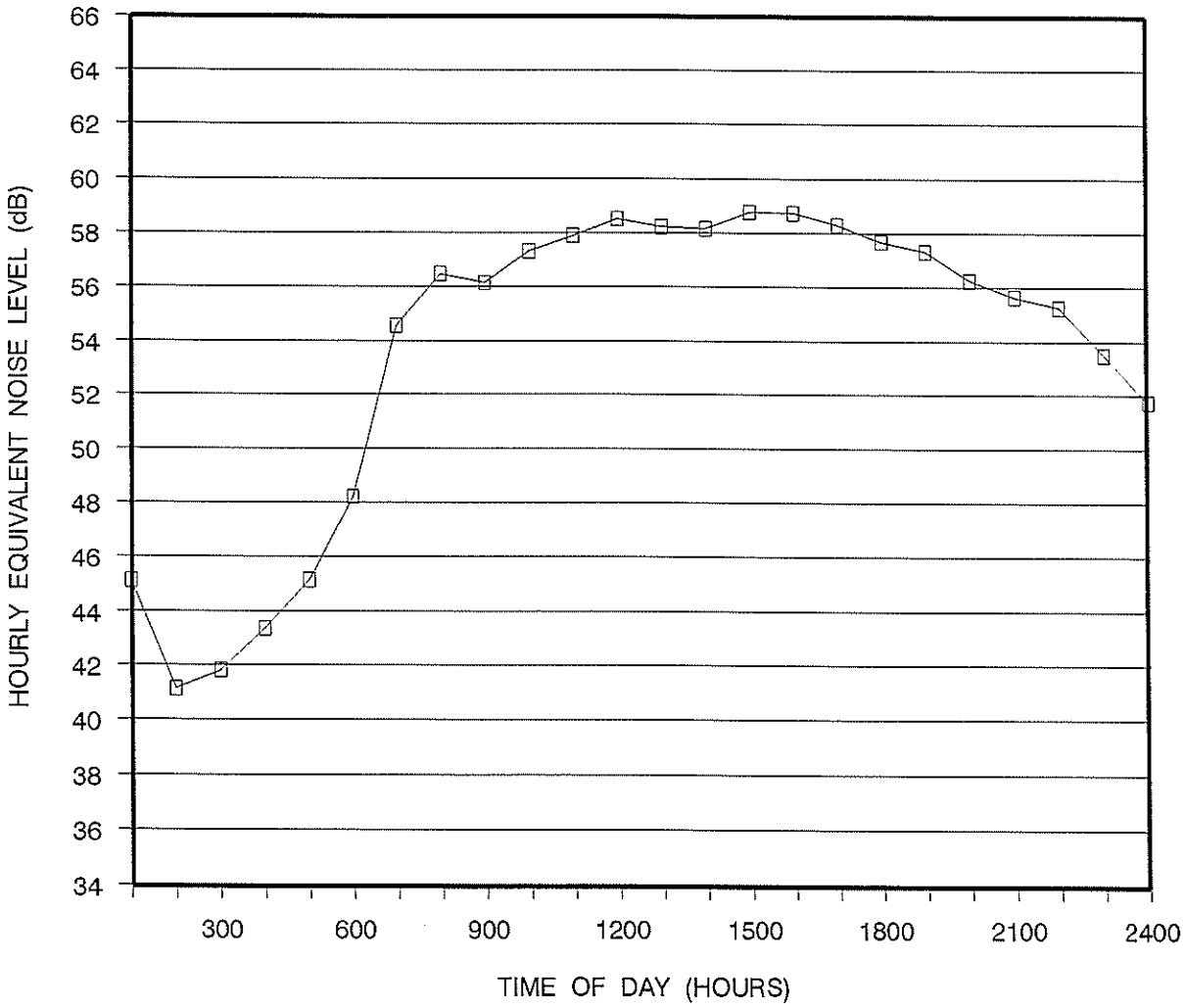
HOURLY VARIATIONS OF TRAFFIC NOISE AT 50 FT SETBACK DISTANCE FROM THE CENTERLINE OF KAMEHAMEHA HIGHWAY WEST OF KUILIMA DRIVE (STA. B72008300907; JANUARY 19, 2011)



□ 50 FT from Roadway Centerline (68.8 DNL)

FIGURE 4

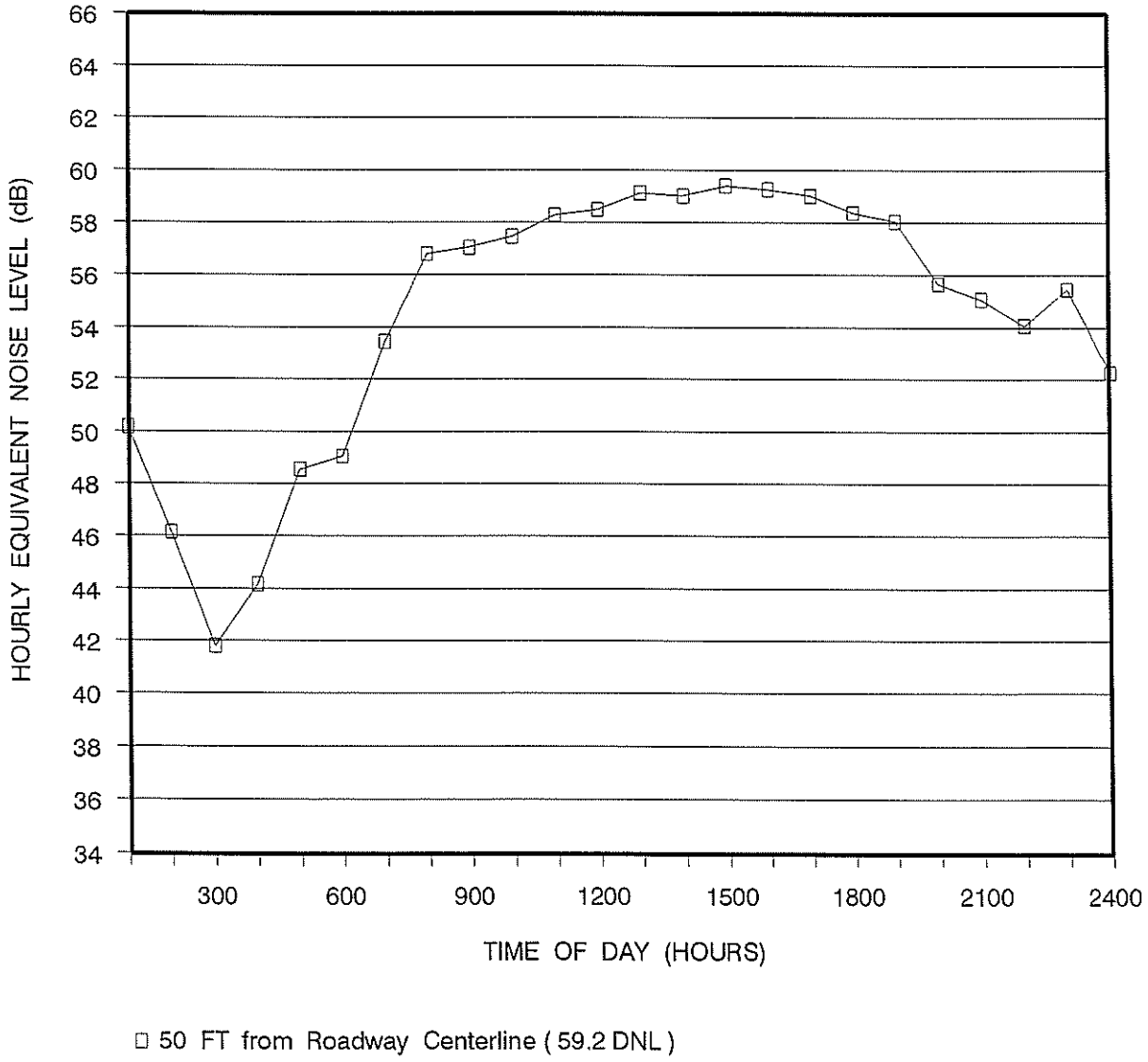
HOURLY VARIATIONS OF TRAFFIC NOISE AT 50 FT SETBACK DISTANCE FROM THE CENTERLINE OF KUILIMA DRIVE AT KAMEHAMEHA HIGHWAY (WEEKDAY; NOVEMBER 3, 2011)

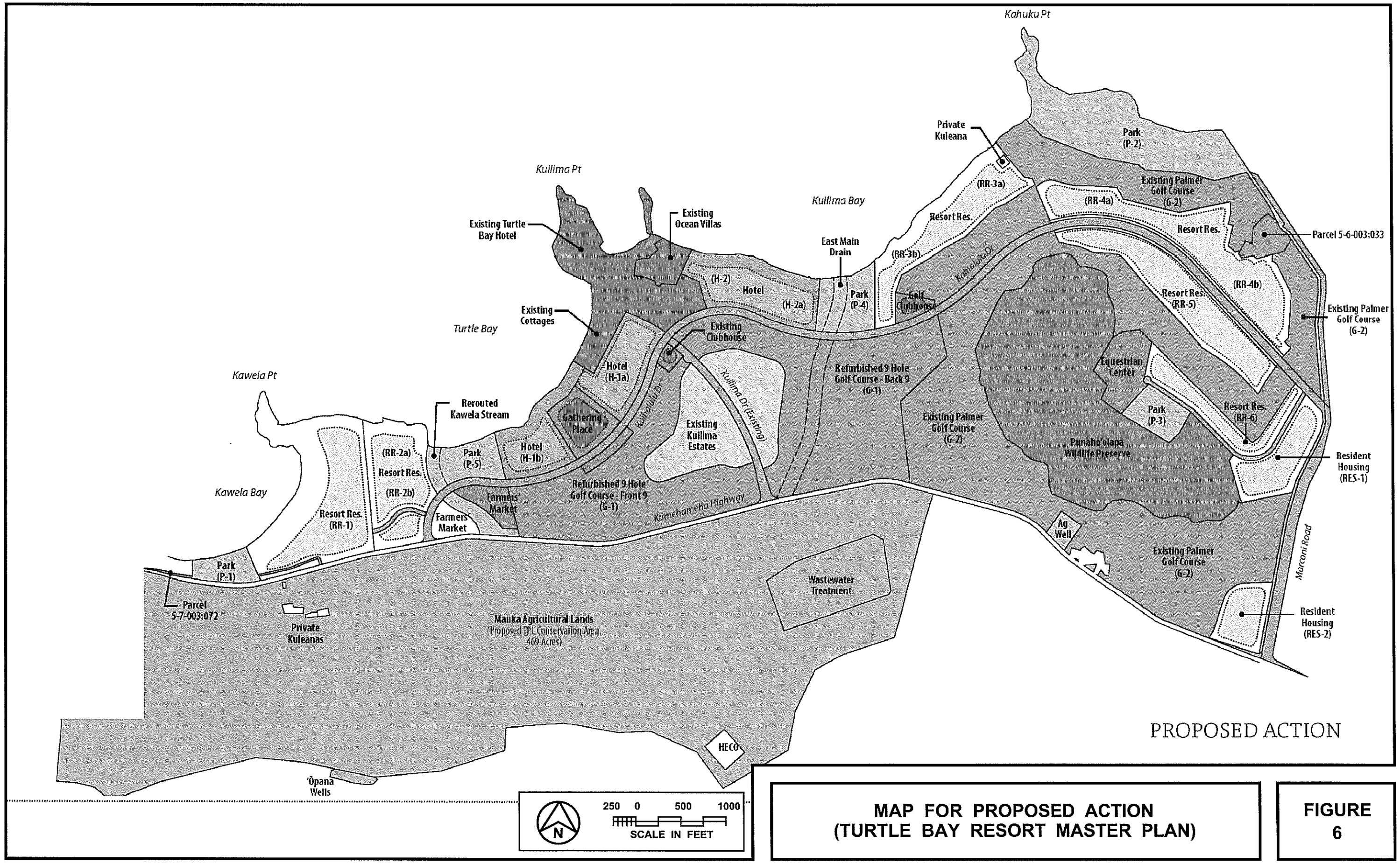


□ 50 FT from Roadway Centerline (58.5 DNL)

FIGURE 5

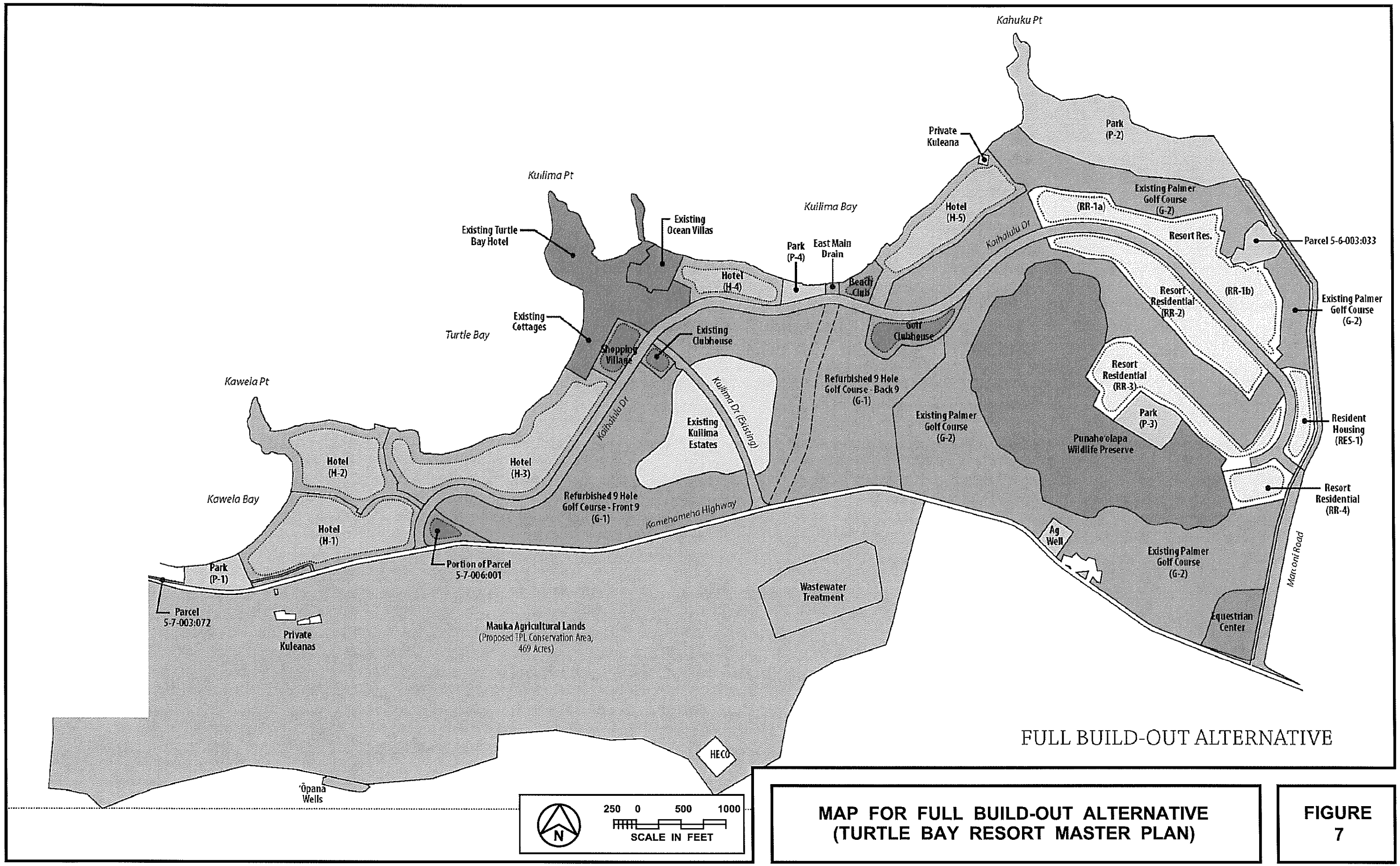
HOURLY VARIATIONS OF TRAFFIC NOISE AT 50 FT SETBACK DISTANCE FROM THE CENTERLINE OF KUILIMA DRIVE AT KAMEHAMEHA HIGHWAY (WEEKEND DAY; NOVEMBER 5, 2011)





MAP FOR PROPOSED ACTION (TURTLE BAY RESORT MASTER PLAN)

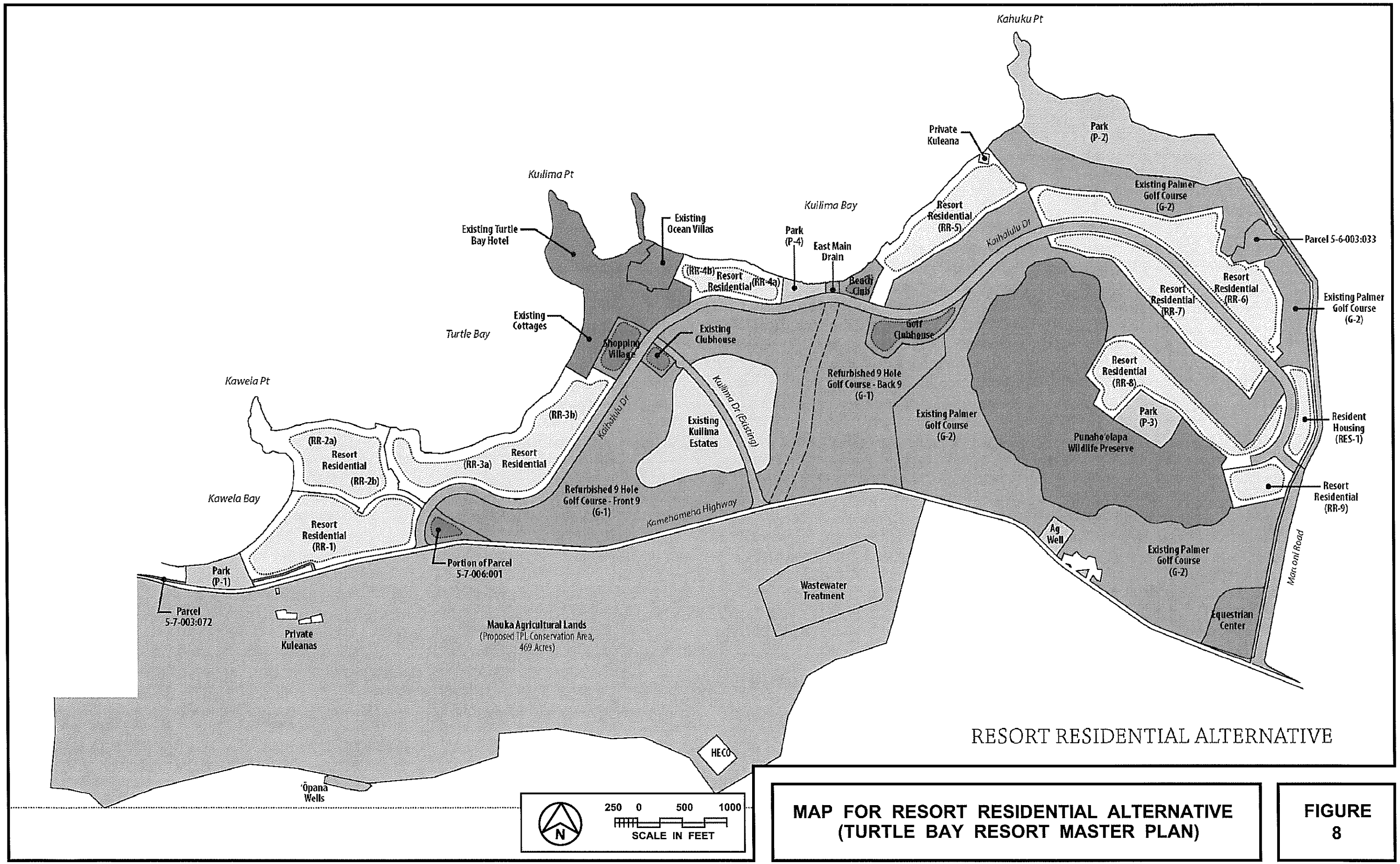
FIGURE 6



FULL BUILD-OUT ALTERNATIVE

MAP FOR FULL BUILD-OUT ALTERNATIVE (TURTLE BAY RESORT MASTER PLAN)

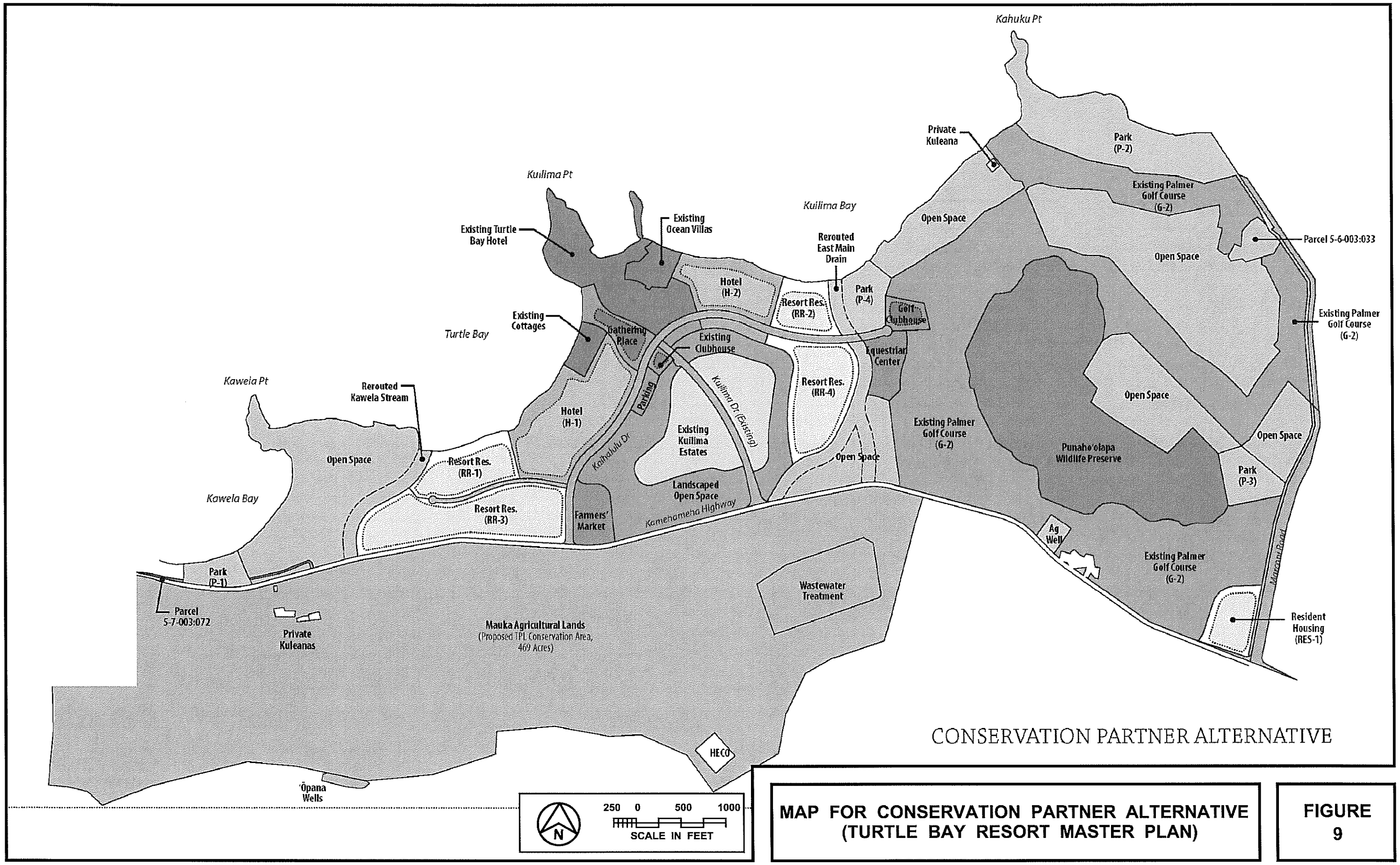
FIGURE 7



RESORT RESIDENTIAL ALTERNATIVE

MAP FOR RESORT RESIDENTIAL ALTERNATIVE (TURTLE BAY RESORT MASTER PLAN)

FIGURE 8



MAP FOR CONSERVATION PARTNER ALTERNATIVE (TURTLE BAY RESORT MASTER PLAN)

FIGURE 9

were qualitative in nature. Quantitative evaluations were performed for the Proposed Action and the Do Nothing Alternative. Discussions of potential traffic and construction noise impacts, and mitigation measures were included in these evaluations.

CHAPTER V. EXISTING NOISE ENVIRONMENT

The existing traffic noise levels in the project environs are controlled by traffic along Kamehameha Highway. Within the Turtle Bay Resort lands, existing background noise levels along the mauka boundaries are controlled by traffic along Kamehameha Highway. Traffic along Kuilima Drive controls background ambient noise levels in the middle section of the resort at the Kuilima Estates. Along the makai boundaries of the resort, surf and resort activities control the background ambient noise levels.

Calculations of existing traffic noise levels during the weekday and weekend PM peak traffic hours are presented in Table 3. The hourly Leq (or Equivalent Sound Level) contribution from each roadway section in the project environs was calculated for comparison with forecasted traffic noise levels with and without the project. The PM peak hour Leq's for a weekday and weekend day were calculated using traffic data from Reference 7. The existing setback distances from the roadways' centerlines to their associated 65, 70, and 75 DNL contours were also calculated as shown in Table 4. The contour line setback distances do not take into account noise shielding effects or the additive contributions of traffic noise from intersecting street sections. Based on the results of Table 4, it was concluded that the existing 65 DNL traffic noise contour is located approximately 59 to 75 FT from the centerline of Kamehameha Highway west of Kuilima Drive, and approximately 57 to 100 FT from the centerline of Kamehameha Highway east of Kuilima Drive.

One existing residence located makai of Kamehameha Highway and approximately 0.70 miles east of Kuilima Drive is located within the existing 65 DNL traffic noise contour, with approximately 68 DNL noise exposure level. The existing traffic noise level at this residence is in the "Significant Exposure, Normally Unacceptable" category (see Table 1).

Approximately thirteen existing residences located makai of Kamehameha Highway and between Pahipahialua Street and Pahipahialua Beach Park are located within the existing 65 DNL traffic noise contour, with traffic noise levels ranging from 66 to 70 DNL. Existing traffic noise levels at these thirteen residences are in the "Significant Exposure, Normally Unacceptable" category (see Table 1).

Existing traffic noise levels along Kuilima Drive at Kuilima Estates are less than 65 DNL along the Rights-of-Way, and the traffic noise contributions from Kuilima Drive range from approximately 54 to 59 DNL at the six multifamily dwelling units closest to Kuilima Drive. Traffic noise contributions from Kamehameha Highway are relatively low, and less than 48 DNL at Kuilima Estates.

Existing background noise levels at the interior portions of the project site beyond 500 feet from Kamehameha Highway are low (between 45 and 55 DNL) due to their large setback distances from Kamehameha Highway. At these interior locations

TABLE 3

EXISTING (CY 2011) TRAFFIC VOLUMES AND NOISE LEVELS ALONG ROADWAYS IN PROJECT AREA (PM PEAK HOUR)

LOCATION	SPEED (MPH)	TOTAL VPH	****** VOLUMES (VPH) ******** AUTOS	M TRUCKS	H TRUCKS	50' Leq	75' Leq	100' Leq
Weekday:								
Kamehameha Hwy. West of Kuilima Dr. (Posted 35 mph)	45	712	701	5	6	66.7	62.7	60.1
Kamehameha Hwy. West of Kuilima Dr. (Posted 45 mph)	55	712	701	5	6	69.1	65.0	62.3
Kamehameha Hwy. East of Kuilima Dr. (Posted 35 mph)	45	663	652	5	6	66.4	62.5	59.8
Kamehameha Hwy. East of Kuilima Dr. (Posted 45 mph)	55	663	652	5	6	68.8	64.8	62.0
Kuilima Dr. At Kamehameha Hwy.	25	341	325	6	10	58.9	55.7	53.5
Kamehameha Hwy. West of Marconi Dr. (Posted 35 mph)	45	654	643	5	6	66.3	62.4	59.8
Kamehameha Hwy. West of Marconi Dr. (Posted 45 mph)	55	654	643	5	6	68.7	64.7	62.0
Kamehameha Hwy. East of Marconi Dr. (Posted 35 mph)	45	663	652	5	6	66.4	62.5	59.8
Kamehameha Hwy. East of Marconi Dr. (Posted 45 mph)	55	663	652	5	6	71.8	67.8	65.0
Marconi Rd. At Kamehameha Hwy.	25	19	19	0	0	46.7	44.0	41.7
Saturday:								
Kamehameha Hwy. West of Kuilima Dr. (Posted 35 mph)	45	871	856	7	8	67.6	63.7	61.0
Kamehameha Hwy. West of Kuilima Dr. (Posted 45 mph)	55	871	856	7	8	70.0	66.0	63.2
Kamehameha Hwy. East of Kuilima Dr. (Posted 35 mph)	45	819	806	6	7	67.3	63.4	60.7
Kamehameha Hwy. East of Kuilima Dr. (Posted 45 mph)	55	819	806	6	7	69.7	65.7	62.9
Kuilima Dr. At Kamehameha Hwy.	25	390	371	7	12	59.5	56.4	54.2
Kamehameha Hwy. West of Marconi Dr. (Posted 35 mph)	45	809	796	6	7	67.2	63.3	60.7
Kamehameha Hwy. West of Marconi Dr. (Posted 45 mph)	55	809	796	6	7	69.6	65.6	62.9
Kamehameha Hwy. East of Marconi Dr. (Posted 35 mph)	45	809	796	6	7	67.2	63.3	60.7
Kamehameha Hwy. East of Marconi Dr. (Posted 45 mph)	55	809	796	6	7	72.6	68.6	65.9
Marconi Rd. At Kamehameha Hwy.	25	16	16	0	0	41.1	38.2	35.4

TABLE 4

EXISTING AND CY 2025 DISTANCES TO 65, 70, AND 75 DNL CONTOURS

STREET SECTION	65 DNL SETBACK (FT)		70 DNL SETBACK (FT)		75 DNL SETBACK (FT)	
	EXISTING	CY 2025	EXISTING	CY 2025	EXISTING	CY 2025
Kamehameha Hwy. West of Kaihalulu Dr. (Posted 35 mph)	59	87	36	50	22	28
Kamehameha Hwy. West of Kaihalulu Dr. (Posted 45 mph)	75	122	46	66	28	37
Kamehameha Hwy. from Kaihalulu to Kuilima (With Median)	75	81	46	46	28	26
Kamehameha Hwy. from Kaihalulu to Kuilima (W/O Median)	75	82	46	45	28	25
Kamehameha Hwy. East of Kuilima Dr. (Posted 35 mph)	58	84	34	48	20	27
Kamehameha Hwy. East of Kuilima Dr. (Posted 45 mph)	73	116	44	63	27	35
Kamehameha Hwy. West of Marconi Dr. (Posted 35 mph)	57	84	34	48	20	27
Kamehameha Hwy. West of Marconi Dr. (Posted 45 mph)	73	116	44	63	26	35
Kamehameha Hwy. East of Marconi Dr. (Posted 35 mph)	58	84	34	48	20	27
Kamehameha Hwy. East of Marconi Dr. (Posted 45 mph)	100	173	60	90	36	49
Kaihalulu Dr. At Kamehameha Hwy.	N/A	29	N/A	15	N/A	7
Kuilima Dr. At Kamehameha Hwy.	23	33	12	17	7	9
Marconi Rd. At Kamehameha Hwy.	3	15	2	8	1	4

Notes:

(1) All setback distances are from the roadways' centerlines.
(2) See TABLES 3 and 5 for traffic volume, speed, and mix assumptions.
(3) Setback distances are for ground level receptors.
(4) "Loose Soil" conditions assumed along all roadways.
(5) DNL values represent 7-day, weekly averages.
(6) With medians and 35 mph posted within 600' of intersections on Kamehameha Highway.
(7) Without medians and 45 mph posted beyond 600' of intersections on Kamehameha Highway, except 35 mph posted between Kuilima Dr and Kaihalulu Dr.

on the project site, distant traffic, helicopter noise, and the natural sounds of surf, birds, and winds in foliage are the dominant noise sources. Between traffic, helicopter, surf, bird, or wind noise events, background ambient noise levels drop to a range of 40 to 45 dBA. During calm wind periods, background ambient noise levels decrease to levels less than 45 dBA at the interior locations removed from Kamehameha Highway, Kuilima Drive, and the shoreline. The minimum background ambient noise levels at these interior locations are controlled by distant traffic, surf, and wind noise.

CHAPTER VI. FUTURE NOISE ENVIRONMENT

Figure 6 depicts the Proposed Action for the Turtle Bay Resort Master Plan. The future traffic noise levels and potential traffic noise impacts associated with the Proposed Action were examined by calculating future traffic noise levels in CY 2025 along Kamehameha Highway, Kuilima Drive, Marconi Road, and the proposed Kaihalulu Drive with the Proposed Action. In addition, future traffic noise levels in CY 2025 along Kamehameha Highway, Kuilima Drive, and Marconi Road were calculated for the Do Nothing (or No Build) Alternative. Future traffic noise levels under the Proposed Action and Do Nothing Alternative were compared with each other as well as with the existing traffic noise levels described in the previous chapter.

Predictions of future traffic noise levels were made using the traffic volume assignments of Reference 7 for CY 2025 with and without the Proposed Action. The future assignments of project plus non-project traffic on the roadway sections which would service the project are shown in Table 5 for the weekday and weekend PM peak hours of traffic. As indicated in Table 6, by CY 2025 and following complete project build-out of the Proposed Action, traffic noise levels on Kamehameha Highway in the areas fronting the project are predicted to increase by 1.2 to 4.3 DNL. The traffic noise increases due to project traffic range from 0.2 to 3.3 DNL. These increases in traffic noise levels are considered to be moderate to high, and reflect the growth in forecasted project and non-project traffic in the project environs by CY 2025.

Table 4 summarizes the predicted increases in the future setback distances to the 65, 70, and 75 DNL traffic noise contour lines along the roadways in the project environs and attributable to both project plus non-project traffic in CY 2025 under the Proposed Action. The setback distances in Table 4 do not include the beneficial effects of noise shielding from terrain features and buildings, or the detrimental effects of additive contributions of noise from intersecting streets. As indicated in Table 4, the setback distances to the 65 DNL contour are predicted to range from 81 to 173 FT from the centerline of Kamehameha Highway following project build-out in CY 2025 under the Proposed Action. The setback distances to the 65 DNL contour are predicted to increase from 23 to 33 FT from the centerline of Kuilima Drive following project build-out in CY 2025. Along the proposed Kaihalulu Drive access road through the project site, the setback distance to the 65 DNL contour is predicted to be approximately 29 FT from the centerline of that roadway.

Table 7 presents the predicted traffic noise levels resulting from both non-project and project traffic on Kamehameha Highway, Kuilima Drive, and Kaihalulu Drive by CY 2025 at various noise sensitive receptor locations in the project environs, and as measured by the DNL descriptor system. The applicable locations of the noise sensitive receptors in the project environs are shown in Figure 10. As indicated in Table 7, future traffic noise levels at existing and planned noise sensitive locations along Kamehameha Highway in the project environs are expected to exceed 65 DNL

TABLE 5

FUTURE (CY 2025) TRAFFIC VOLUMES AND NOISE LEVELS ALONG ROADWAYS IN PROJECT AREA (PROPOSED ACTION; PM PEAK HOUR, BUILD)

LOCATION	SPEED (MPH)	TOTAL VPH	****** VOLUMES (VPH) ******** AUTOS	M TRUCKS	H TRUCKS	50' Leq	75' Leq	100' Leq
Weekday:								
Kamehameha Hwy. West of Kaihalulu Dr. (Posted 35 mph)	45	1,473	1,449	11	13	70.0	66.5	63.7
Kamehameha Hwy. West of Kaihalulu Dr. (Posted 45 mph)	55	1,473	1,449	11	13	72.4	68.9	66.6
Kaihalulu Dr. At Kamehameha Hwy.	25	449	428	8	13	61.2	58.3	56.1
Kamehameha Hwy. from Kaihalulu to Kuilima (With Median)	45	1,205	1,185	9	11	69.2	65.7	62.9
Kamehameha Hwy. from Kaihalulu to Kuilima (W/O Median)	45	1,205	1,185	9	11	69.1	65.7	63.5
Kamehameha Hwy. East of Kuilima Dr. (Posted 35 mph)	45	1,341	1,319	10	12	69.6	66.1	63.3
Kamehameha Hwy. East of Kuilima Dr. (Posted 45 mph)	55	1,341	1,319	10	12	72.0	68.5	66.2
Kuilima Dr. At Kamehameha Hwy.	25	716	683	12	21	61.9	58.8	56.7
Kamehameha Hwy. West of Marconi Dr. (Posted 35 mph)	45	1,341	1,319	10	12	69.6	66.1	63.3
Kamehameha Hwy. West of Marconi Dr. (Posted 45 mph)	55	1,341	1,319	10	12	72.0	68.5	66.2
Kamehameha Hwy. East of Marconi Dr. (Posted 35 mph)	45	1,320	1,298	10	12	69.6	66.1	63.3
Kamehameha Hwy. East of Marconi Dr. (Posted 45 mph)	55	1,320	1,298	10	12	74.9	71.4	69.2
Marconi Rd. At Kamehameha Hwy.	25	299	294	2	3	55.3	52.1	50.1
Saturday:								
Kamehameha Hwy. West of Kaihalulu Dr. (Posted 35 mph)	45	1,784	1,755	13	16	70.9	67.4	64.6
Kamehameha Hwy. West of Kaihalulu Dr. (Posted 45 mph)	55	1,784	1,755	13	16	73.2	69.7	67.5
Kaihalulu Dr. At Kamehameha Hwy.	25	616	588	10	18	60.4	57.3	55.1
Kamehameha Hwy. from Kaihalulu to Kuilima (With Median)	45	1,478	1,454	11	13	70.1	66.6	63.7
Kamehameha Hwy. from Kaihalulu to Kuilima (W/O Median)	45					70.0	66.6	64.4
Kamehameha Hwy. East of Kuilima Dr. (Posted 35 mph)	45	1,630	1,603	12	15	70.5	67.0	64.2
Kamehameha Hwy. East of Kuilima Dr. (Posted 45 mph)	55	1,630	1,603	12	15	72.8	69.3	67.1
Kuilima Dr. At Kamehameha Hwy.	25	774	738	13	23	61.4	58.3	56.1
Kamehameha Hwy. West of Marconi Dr. (Posted 35 mph)	45	1,630	1,603	12	15	70.5	67.0	64.2
Kamehameha Hwy. West of Marconi Dr. (Posted 45 mph)	55	1,630	1,603	12	15	72.8	69.3	67.1
Kamehameha Hwy. East of Marconi Dr. (Posted 35 mph)	45	1,592	1,566	12	14	70.4	66.9	64.1
Kamehameha Hwy. East of Marconi Dr. (Posted 45 mph)	55	1,592	1,566	12	14	75.7	72.2	70.0
Marconi Rd. At Kamehameha Hwy.	25	518	509	4	5	57.6	54.5	52.5

Notes:

1. With medians and 35 mph posted within 600' of intersections on Kamehameha Highway.
2. Without medians and 45 mph posted beyond 600' of intersections on Kamehameha Highway, except 35 mph posted between Kuilima Dr and Kaihalulu Dr.

TABLE 6

CALCULATIONS OF PROJECT AND NON-PROJECT TRAFFIC NOISE CONTRIBUTIONS (CY 2025) (PM PEAK HOUR LEQ OR DNL)

STREET SECTION	NOISE LEVEL INCREASE DUE TO: NON-PROJECT TRAFFIC	PROJECT TRAFFIC
Kamehameha Hwy. West of Kaihalulu Dr. (Posted 35 mph)	1.0	2.6
Kamehameha Hwy. West of Kaihalulu Dr. (Posted 45 mph)	1.0	3.3
Kaihalulu Dr. At Kamehameha Hwy.	N/A	16.2
Kamehameha Hwy. from Kaihalulu to Kuilima (With Median)	1.0	1.8
Kamehameha Hwy. from Kaihalulu to Kuilima (W/O Median)	1.0	0.2
Kamehameha Hwy. East of Kuilima Dr. (Posted 35 mph)	1.1	2.4
Kamehameha Hwy. East of Kuilima Dr. (Posted 45 mph)	1.1	3.1
Kuilima Dr. At Kamehameha Hwy.	0.8	2.4
Kamehameha Hwy. West of Marconi Dr. (Posted 35 mph)	1.1	2.4
Kamehameha Hwy. West of Marconi Dr. (Posted 45 mph)	1.1	3.1
Kamehameha Hwy. East of Marconi Dr. (Posted 35 mph)	1.2	2.3
Kamehameha Hwy. East of Marconi Dr. (Posted 45 mph)	1.2	3.0
Marconi Rd. At Kamehameha Hwy.	0.0	8.4

Notes:

1. With medians and 35 mph posted within 600' of intersections on Kamehameha Highway.
2. Without medians and 45 mph posted beyond 600' of intersections on Kamehameha Highway, except 35 mph posted between Kuilima Dr. and Kaihalulu Dr.
3. At 50' from centerline of Kaihalulu Dr., future traffic noise levels predicted to be 16.2 DNL above existing background noise levels.

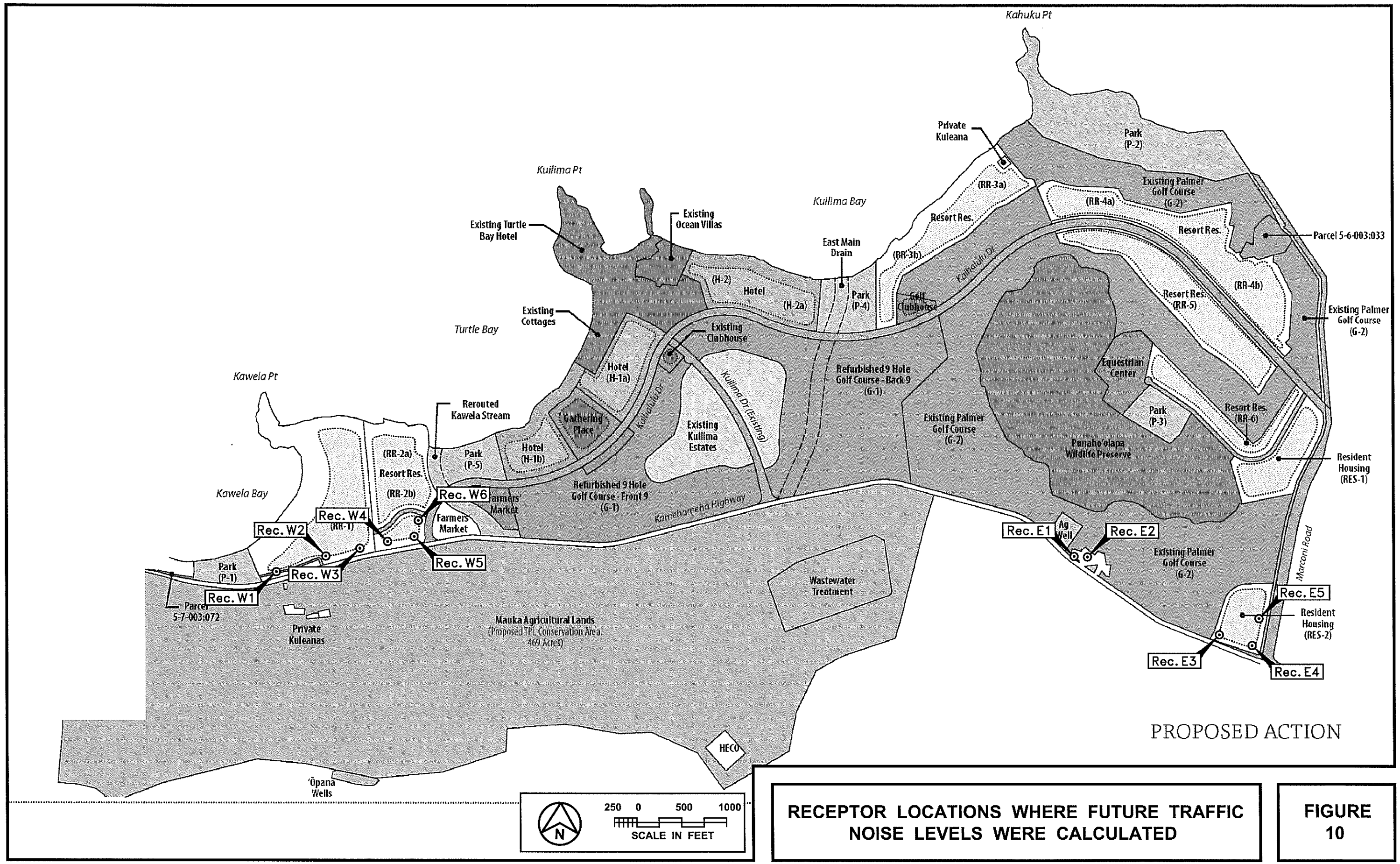
TABLE 7

PREDICTED TRAFFIC NOISE LEVELS AT VARIOUS RECEPTOR LOCATIONS (4.92 FT HIGH RECEPTOR, 2025 DNL, WITH PROPOSED ACTION)

RECEPTOR LOCATION	SETBACK DIST. FROM EXIST. C.L.	2025 DNL W/O MITIGATION	2025 DNL WITH MITIGATION
Receiver #W1 (RR-1)	110 FT	66.9	61.0
Receiver #W2 (RR-1)	120 FT	66.4	60.2
Receiver #W3 (RR-1)	120 FT	65.9	60.2
Receiver #W4 (RR-2b)	135 FT	63.8	N/A
Receiver #W5 (RR-2b)	115 FT	65.1	60.4
Receiver #W6 (RR-2b)	310 FT	58.2	N/A
Receiver #E1 (TMK: 5-6-003:036)	48 FT	72.1	64.9
Receiver #E2 (TMK: 5-6-003:036)	106 FT	65.7	60.9
Receiver #E3 (RES-2)	110 FT	64.9	N/A
Receiver #E4 (RES-2))	120 FT	64.1	N/A
Receiver #E5 (RES-2)	454 FT	53.1	N/A

Notes:

1. Traffic noise levels include contributions from intersecting roadways.
2. "Loose Soil" ground attenuation assumed.
3. Minimum 6 foot high sound attenuation walls assumed for noise mitigation.



RECEPTOR LOCATIONS WHERE FUTURE TRAFFIC NOISE LEVELS WERE CALCULATED

FIGURE 10

without noise mitigation measures. Existing residences west of Kawela Bay and two existing residences located approximately 0.7 miles east of Kuilima Drive are predicted to experience future traffic noise levels greater than 65 DNL.

Calculations of future traffic noise levels under the Proposed Action at noise sensitive receptor locations shown in Figure 10 are presented in Table 7. Primarily as a result of forecasted traffic along Kamehameha Highway, future traffic noise levels at the Resort Residential (RR-1 and RR-2b) lots at locations W1, W2, W3, and W5 which front the highway are predicted to exceed the 65 DNL FHA/HUD noise standard. Due to even smaller setback distances from the highway, the Park (P-1) west of the Resort Residential (RR-1) lots will also experience traffic noise levels greater than 65 DNL. The proposed Resident Housing (RES-2) lots at locations E3, E4, and E5 west of the Marconi Road intersection should experience traffic noise levels which do not exceed the FHA/HUD standard of 65 DNL. Exceedances of the 65 DNL FHA/HUD noise standard are also expected at the two existing residences (E1 and E2) 0.7 miles east of the Kuilima Drive intersection. At one of the residences (E1), existing traffic noise levels currently exceed 65 DNL.

Along Kamehameha Highway west of the project to Pahipahialua Beach Park, the number of existing residences which experience traffic noise levels greater than 65 DNL will increase from thirteen to eighteen by 2025 under the Proposed Action. From Table 4, the setback distance to the 65 DNL contour in this residential area west of the project is predicted to increase from 75 to 122 FT setback distance to the highway centerline.

Along Kuilima Drive, and probably along the new Kaihalulu Drive, existing and future residences are predicted to experience traffic noise levels below 65 DNL, and be in the "Moderate Exposure, Acceptable" noise exposure category of Table 1.

CHAPTER VII. DISCUSSION OF PROJECT RELATED NOISE IMPACTS AND POSSIBLE NOISE MITIGATION MEASURES

Traffic Noise with Proposed Action. The increases in traffic noise levels attributable to the Proposed Action from the present to CY 2025 are predicted to range from 0.2 to 3.3 DNL along Kamehameha Highway, where traffic noise levels are expected to continue to be above 65 DNL along the highway Rights-of-Way. These increases in traffic noise levels along Kamehameha Highway which are attributable to the Proposed Action are considered to be in the moderate to high category, and are greater than the traffic noise level increases of approximately 1.0 DNL expected as a result of non-project traffic. Except for the two existing residences east of Kuilima Drive, the lands along the highway Rights-of-Way are generally vacant between Kawela Bay and Marconi Road. The closest noise sensitive residences beyond the project area are located west of Kawela Bay. Along public roadways, where traffic noise levels result from both project and non-project traffic, traffic noise mitigation measures are implemented by private land owners. Government agencies (such as the Hawaii State Department of Transportation, Highways Division) typically address traffic noise impacts within the limits of construction during public roadway improvement projects, and include traffic noise mitigation measures if they are considered to be "reasonable and feasible."

At noise sensitive receptor locations W1, W2, W3, W5, E1, and E2 (see Figure 10), future traffic noise levels with the Proposed Action are predicted to exceed the 65 DNL FHA/HUD noise standard. At locations W1, W2, W3, E1, and E2, reductions in the posted speed limit from 45 miles per hour to 35 miles per hour would reduce predicted traffic noise levels by approximately 2 DNL and to levels below the 65 DNL FHA/HUD noise standard at locations W3, W5, and E2. Predicted future traffic noise levels at receptor locations W1, W3, and E1 would still remain above 65 DNL with or without a 10 miles per hour reduction in the posted speed limit.

Other possible traffic noise mitigation measures are: increasing the setback distances of the receptors from the highway; constructing sound attenuating walls or berms between the highway and the receptors; or closure and air conditioning of the affected dwellings. Increasing the setback distances of future residences to 122 FT from the centerline of Kamehameha Highway should be considered as a possible noise mitigation measure. Alternately, the addition of approximately 6 FT high sound attenuating walls (or berms) would reduce future traffic noise levels below 65 DNL at single story structures in the Resort Residential area and at the two existing residences at locations E1 and E2. For two story (or higher) structures, the wall/berm height requirements increase due to the higher elevations of receptors on the upper floors. Whenever mitigation of traffic noise at the upper floors are required, the use of closure and air conditioning, or the use of sound attenuating windows are the more appropriate sound attenuation measures.

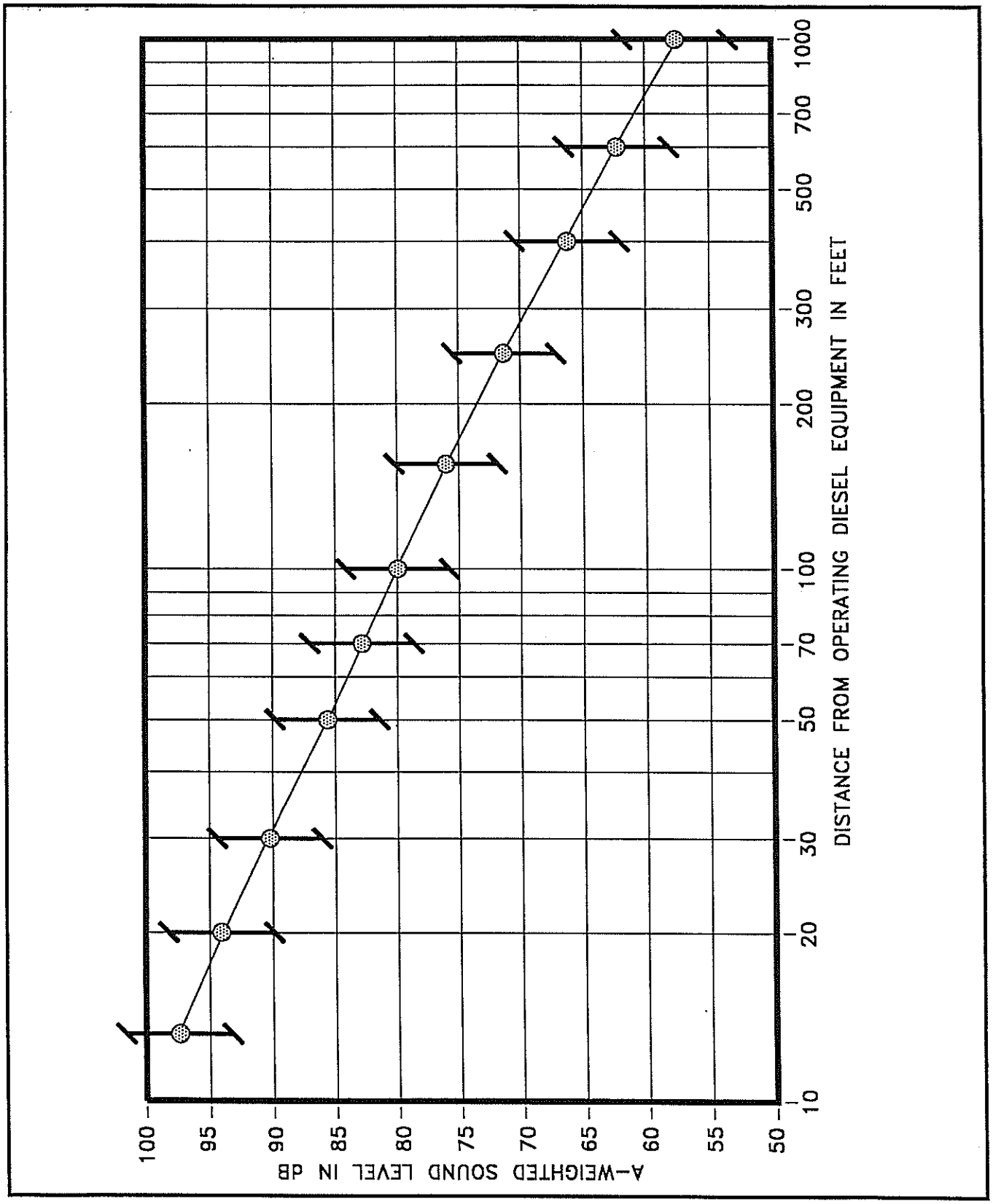
At existing receptor locations W1, W2, W3, W5, E1, and E2, the effectiveness of sound attenuating walls was examined. These results are shown in Table 7. Driveways to each residence will limit the sound attenuation performance of 6 FT high walls to approximately 4 to 7 dB, but these levels of attenuation should be sufficient to reduce future traffic noise to levels below 65 DNL at the affected dwellings.

Traffic Noise with Other Development Alternatives. A qualitative evaluation was performed to identify the differences in potential traffic noise levels among the Proposed Action and the three Master Plan Alternatives shown in Figures 6 through 9. The four Master Plan Alternatives (including the Proposed Action) were ranked in respect to the following:

- Increase in future traffic noise levels along Kamehameha Highway at existing residences west of Kuilima Drive due to the project;
- Increase in future traffic noise levels along Kamehameha Highway at existing residences east of Kuilima Drive due to the project;
- Increase in future traffic noise levels along Kuilima Drive at existing residences along Kuilima Drive;
- Potential traffic noise mitigation measures at existing and future residences along Kamehameha Highway within project limits; and
- Potential traffic noise mitigation measures at existing residences along Kamehameha Highway beyond project limits to Pahipahialua Beach Park.

The resulting rankings of the four alternatives, from lowest traffic noise impact to highest traffic noise impact were: Resort Residential Alternative; Conservation Partner Alternative; Proposed Action; and Full Build-Out Alternative. Future traffic volumes were lower under the Resort Residential and Conservation Partner Alternative, so they would cause the least traffic noise impacts at existing residences within and beyond the project area. In respect to minimizing traffic noise impacts on future residences within the project area, the Full Build-Out Alternative was ranked highest (or best) due to the location of hotel units and the Equestrian Center rather than residences next to Kamehameha Highway. Nevertheless, in all other aspects, the Full Build-Out Alternative was expected to cause the greatest noise impacts.

Construction Noise. Audible construction noise will probably be unavoidable during the entire project construction period. The total time period for construction is unknown, but it is anticipated that the actual work will be moving from one location on the project site to another during that period. Actual length of exposure to construction noise at any receptor location will probably be less than the total construction period for the entire project. Typical levels of noise from construction activity (excluding pile driving activity) are shown in Figure 11. Risks of adverse noise impacts during construction are highest at the existing hotel Cottages and Ocean Villas, and the

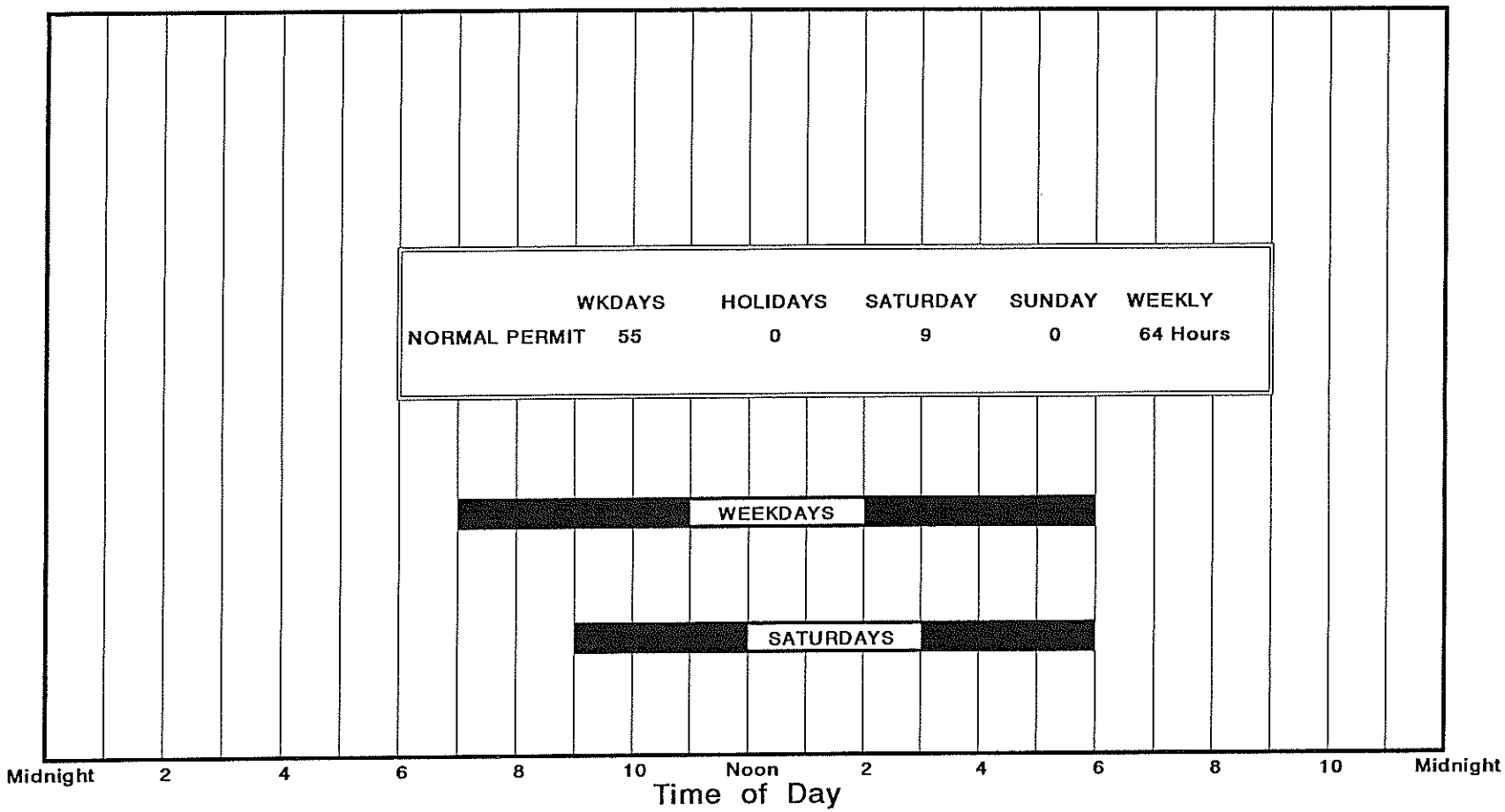


ANTICIPATED RANGE OF CONSTRUCTION NOISE LEVELS VS. DISTANCE

FIGURE 11

existing residences at Kuilima Estates. Adverse impacts from construction noise are not expected to be in the "public health and welfare" category due to the temporary nature of the work and due to the administrative controls available for its regulation. Instead, these impacts will probably be limited to the temporary degradation of the quality of the acoustic environment in the immediate vicinity of the project site.

Elimination of construction noise to inaudible levels will not be practical in all cases due to the intensity of construction noise sources (80 to 90+ dB at 50 FT distance), and due to the exterior nature of the work (grading and earth moving, trenching, concrete pouring, hammering, etc.). The use of properly muffled construction equipment should be required on the job site. The incorporation of State Department of Health construction noise limits and curfew times, which are applicable on the island of Oahu (Reference 5), is another noise mitigation measure which can be applied to this project. Figure 12 depicts the normally permitted hours of construction for construction noise as well as the curfew periods for construction noise. Noisy construction activities are not allowed on Sundays and holidays under the DOH permit procedures.



AVAILABLE WORK HOURS UNDER DOH PERMIT PROCEDURES FOR CONSTRUCTION NOISE

FIGURE 12

APPENDIX A. REFERENCES

(1) "Guidelines for Considering Noise in Land Use Planning and Control;" Federal Interagency Committee on Urban Noise; June 1980.

(2) American National Standard, "Sound Level Descriptors for Determination of Compatible Land Use," ANSI S12.9-1998/ Part 5; Acoustical Society of America.

(3) "Environmental Criteria and Standards, Noise Abatement and Control, 24 CFR, Part 51, Subpart B;" U.S. Department of Housing and Urban Development; July 12, 1979.

(4) "Information on Levels of Environmental Noise Requisite to Protect the Public Health and Welfare with an Adequate Margin of Safety;" U.S. Environmental Protection Agency; EPA 550/9-74- 004; March 1974.

(5) "Title 11, Administrative Rules, Chapter 46, Community Noise Control;" Hawaii State Department of Health; September 23, 1996.

(6) "FHWA Highway Traffic Noise Model User's Guide;" FHWA-PD-96-009, Federal Highway Administration; Washington, D.C.; January 1998 and Version 2.5 Upgrade (April 14, 2004).

(7) Existing and Future Traffic Volumes for the Turtle Bay Resort Master Plan; The Traffic Management Consultant; November 2011 and August 8, 2012.

(8) 24-Hour Traffic Counts, Station B72008300907, Kamehameha Highway West of Kuilima Drive; State Department of Transportation; January 19, 2011.

APPENDIX B

EXCERPTS FROM EPA'S ACOUSTIC TERMINOLOGY GUIDE

Descriptor Symbol Usage

The recommended symbols for the commonly used acoustic descriptors based on A-weighting are contained in Table I. As most acoustic criteria and standards used by EPA are derived from the A-weighted sound level, almost all descriptor symbol usage guidance is contained in Table I.

Since acoustic nomenclature includes weighting networks other than "A" and measurements other than pressure, an expansion of Table I was developed (Table II). The group adopted the ANSI descriptor-symbol scheme which is structured into three stages. The first stage indicates that the descriptor is a level (i.e., based upon the logarithm of a ratio), the second stage indicates the type of quantity (power, pressure, or sound exposure), and the third stage indicates the weighting network (A, B, C, D, E.....). If no weighting network is specified, "A" weighting is understood. Exceptions are the A-weighted sound level and the A-weighted peak sound level which require that the "A" be specified. For convenience in those situations in which an A-weighted descriptor is being compared to that of another weighting, the alternative column in Table II permits the inclusion of the "A". For example, a report on blast noise might wish to contrast the LCdn with the LAdn.

Although not included in the tables, it is also recommended that "Lpn" and "LepN" be used as symbols for perceived noise levels and effective perceived noise levels, respectively.

It is recommended that in their initial use within a report, such terms be written in full, rather than abbreviated. An example of preferred usage is as follows:

The A-weighted sound level (LA) was measured before and after the installation of acoustical treatment. The measured LA values were 85 and 75 dB respectively.

Descriptor Nomenclature

With regard to energy averaging over time, the term "average" should be discouraged in favor of the term "equivalent". Hence, Leq, is designated the "equivalent sound level". For Ld, Ln, and Ldn, "equivalent" need not be stated since the concept of day, night, or day-night averaging is by definition understood. Therefore, the designations are "day sound level", "night sound level", and "day-night sound level", respectively.

The peak sound level is the logarithmic ratio of peak sound pressure to a reference pressure and not the maximum root mean square pressure. While the latter is the maximum sound pressure level, it is often incorrectly labelled peak. In that sound level meters have "peak" settings, this distinction is most important.

"Background ambient" should be used in lieu of "background", "ambient", "residual", or "indigenous" to describe the level characteristics of the general background noise due to the contribution of many unidentifiable noise sources near and far.

With regard to units, it is recommended that the unit decibel (abbreviated dB) be used without modification. Hence, DBA, PNdB, and EPNdB are not to be used. Examples of this preferred usage are: the Perceived Noise Level (Lpn was found to be 75 dB. Lpn = 75 dB). This decision was based upon the recommendation of the National Bureau of Standards, and the policies of ANSI and the Acoustical Society of America, all of which disallow any modification of bel except for prefixes indicating its multiples or submultiples (e.g., deci).

Noise Impact

In discussing noise impact, it is recommended that "Level Weighted Population" (LWP) replace "Equivalent Noise Impact" (ENI). The term "Relative Change of Impact" (RCI) shall be used for comparing the relative differences in LWP between two alternatives.

Further, when appropriate, "Noise Impact Index" (NII) and "Population Weighed Loss of Hearing" (PHL) shall be used consistent with CHABA Working Group 69 Report Guidelines for Preparing Environmental Impact Statements (1977).

APPENDIX B (CONTINUED)

TABLE I

A-WEIGHTED RECOMMENDED DESCRIPTOR LIST

TERM	SYMBOL
1. A-Weighted Sound Level	L_A
2. A-Weighted Sound Power Level	L_{WA}
3. Maximum A-Weighted Sound Level	L_{max}
4. Peak A-Weighted Sound Level	L_{Apk}
5. Level Exceeded x% of the Time	L_x
6. Equivalent Sound Level	L_{eq}
7. Equivalent Sound Level over Time (T) (1)	$L_{eq(T)}$
8. Day Sound Level	L_d
9. Night Sound Level	L_n
10. Day-Night Sound Level	L_{dn}
11. Yearly Day-Night Sound Level	$L_{dn(Y)}$
12. Sound Exposure Level	L_{SE}

(1) Unless otherwise specified, time is in hours (e.g. the hourly equivalent level is $L_{eq(1)}$). Time may be specified in non-quantitative terms (e.g., could be specified a $L_{eq(WASH)}$ to mean the washing cycle noise for a washing machine).

SOURCE: EPA ACOUSTIC TERMINOLOGY GUIDE, BNA 8-14-78,

APPENDIX B (CONTINUED)

TABLE II

RECOMMENDED DESCRIPTOR LIST

TERM	A-WEIGHTING	ALTERNATIVE[1] A-WEIGHTING	OTHER[2] WEIGHTING	UNWEIGHTED
1. Sound (Pressure)[3] Level	L_A	L_{pA}	L_B, L_{pB}	L_p
2. Sound Power Level	L_{WA}		L_{WB}	L_W
3. Max. Sound Level	L_{max}	L_{Amax}	L_{Bmax}	L_{pmax}
4. Peak Sound (Pressure) Level	L_{Apk}		L_{Bpk}	L_{pk}
5. Level Exceeded x% of the Time	L_x	L_{Ax}	L_{Bx}	L_{px}
6. Equivalent Sound Level	L_{eq}	L_{Aeq}	L_{Beq}	L_{peq}
7. Equivalent Sound Level[4] Over Time(T)	$L_{eq(T)}$	$L_{Aeq(T)}$	$L_{Beq(T)}$	$L_{peq(T)}$
8. Day Sound Level	L_d	L_{Ad}	L_{Bd}	L_{pd}
9. Night Sound Level	L_n	L_{An}	L_{Bn}	L_{pn}
10. Day-Night Sound Level	L_{dn}	L_{Adn}	L_{Bdn}	L_{pdn}
11. Yearly Day-Night Sound Level	$L_{dn(Y)}$	$L_{Adn(Y)}$	$L_{Bdn(Y)}$	$L_{pdn(Y)}$
12. Sound Exposure Level	L_S	L_{SA}	L_{SB}	L_{Sp}
13. Energy Average Value Over (Non-Time Domain) Set of Observations	$L_{eq(e)}$	$L_{Aeq(e)}$	$L_{Beq(e)}$	$L_{peq(e)}$
14. Level Exceeded x% of the Total Set of (Non-Time Domain) Observations	$L_{x(e)}$	$L_{Ax(e)}$	$L_{Bx(e)}$	$L_{px(e)}$
15. Average L_x Value	L_x	L_{Ax}	L_{Bx}	L_{px}

(1) "Alternative" symbols may be used to assure clarity or consistency.

(2) Only B-weighting shown. Applies also to C,D,E,.....weighting.

(3) The term "pressure" is used only for the unweighted level.

(4) Unless otherwise specified, time is in hours (e.g., the hourly equivalent level is Leq(1). Time may be specified in non-quantitative terms (e.g., could be specified as Leq(WASH) to mean the washing cycle noise for a washing machine.

APPENDIX C

SUMMARY OF BASE YEAR AND YEAR 2025 (PROPOSED ACTION) TRAFFIC VOLUMES DURING PM PEAK HOUR AND SATURDAY PEAK HOUR

ROADWAY LANES	******** CY 2011 *********		*** CY 2025 (NO BUILD) **		*** CY 2025 (BUILD) ****	
	WEEKDAY	SATURDAY	WEEKDAY	SATURDAY	WEEKDAY	SATURDAY
Kamehameha Hwy. West of Kaihalulu Dr. (EB)	344	445	438	524	714	892
Kamehameha Hwy. West of Kaihalulu Dr. (WB)	368	426	458	522	759	892
Two-Way	712	871	896	1,046	1,473	1,784
Kamehameha Hwy. East of Kaihalulu Dr. (EB)	344	445	438	524	580	753
Kamehameha Hwy. East of Kaihalulu Dr. (WB)	368	426	458	522	624	725
Two-Way	712	871	896	1,046	1,204	1,478
Kaihalulu Dr. at Kamehameha Hwy. (NB)	N/A	N/A	N/A	N/A	224	294
Kaihalulu Dr. at Kamehameha Hwy. (SB)	N/A	N/A	N/A	N/A	225	322
Two-Way	N/A	N/A	N/A	N/A	449	616
Kamehameha Hwy. West of Kuilima Dr. (EB)	344	445	438	524	581	753
Kamehameha Hwy. West of Kuilima Dr. (WB)	368	426	458	522	624	725
Two-Way	712	871	896	1,046	1,205	1,478
Kamehameha Hwy. East of Kuilima Dr. (EB)	310	402	395	480	625	836
Kamehameha Hwy. East of Kuilima Dr. (WB)	353	417	455	518	716	794
Two-Way	663	819	850	998	1,341	1,630
Kuilima Dr. at Kamehameha Hwy. (NB)	180	212	226	254	382	380
Kuilima Dr. at Kamehameha Hwy. (SB)	161	178	186	214	334	394
Two-Way	341	390	412	468	716	774
Kamehameha Hwy. West of Marconi Rd. (EB)	306	394	395	480	625	836
Kamehameha Hwy. West of Marconi Rd. (WB)	348	415	455	518	716	794
Two-Way	654	809	850	998	1,341	1,630
Kamehameha Hwy. East of Marconi Rd. (EB)	311	394	396	478	613	795
Kamehameha Hwy. East of Marconi Rd. (WB)	352	415	463	520	707	797
Two-Way	663	809	859	998	1,320	1,592
Marconi Rd. at Kamehameha Hwy. (NB)	9	8	9	8	147	279
Marconi Rd. at Kamehameha Hwy. (SB)	10	8	10	8	152	239
Two-Way	19	16	19	16	299	518

J

APPENDIX J:

AIR IMPACT ANALYSIS

AIR QUALITY STUDY

FOR THE PROPOSED

TURTLE BAY RESORT EXPANSION PROJECT

KAHUKU, OAHU, HAWAII

Prepared for:

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1 Summary of State of Hawaii and National Ambient Air Quality Standards

2 Air Pollution Emissions Inventory for Island of Oahu, 1993

3 Annual Summaries of Ambient Air Quality Measurements for Monitoring Stations Nearest Turtle Bay Expansion Project

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4 Estimated Worst-Case 1-Hour Carbon Monoxide Concentrations Along Roadways Near Turtle Bay Expansion Project

5 Estimated Worst-Case 8-Hour Carbon Monoxide Concentrations Along Roadways Near Turtle Bay Expansion Project

6 Estimated Annual Electrical Demand for Turtle Bay Expansion Project

7 Estimated Indirect Air Pollution Emissions from Turtle Bay Expansion Project Electrical Demand

8 Estimated Annual Solid Waste Disposal Demand for Turtle Bay Expansion Project

9 Estimated Indirect Air Pollution Emissions from Turtle Bay Expansion Project Solid Waste Disposal Demand

1.0 SUMMARY

Turtle Bay Resort is proposing the Turtle Bay Resort Expansion Project at Turtle Bay, Oahu. A Supplemental Environmental Impact Statement (SEIS) is required before the expansion project can be implemented. This report was prepared to support the SEIS. The SEIS recommends a Proposed Action and three alternatives. The three alternatives are referred to as: Conservation Partner Alternative, Full Build-Out Alternative and Resort Residential Alternative. As discussed in the SEIS, the Proposed Action is expected to be completed and fully occupied by 2025. This study examines the potential short- and long-term air quality impacts that could occur as a result of implementation of the Proposed Action and suggests mitigation measures to reduce any potential air quality impacts where possible and appropriate.

Both federal and state standards have been established to maintain ambient air quality. At the present time, seven parameters are regulated including: particulate matter, sulfur dioxide, hydrogen sulfide, nitrogen dioxide, carbon monoxide, ozone and lead. Hawaii air quality standards are generally comparable to the national standards although the state standards for carbon monoxide are more stringent than the national standards.

Regional and local climate together with the amount and type of human activity generally dictate the air quality of a given location. The climate of the project area is very much affected

by its windward and coastal situation. Winds are predominantly trade winds from the east-northeast except for occasional periods when kona storms may generate strong winds from the south or when the trade winds are weak and landbreeze-seabreeze circulations may develop. There are no published wind data for the area, but ventilation is good much of the time due to the exposure to the trade winds. Temperatures in the project area are generally very moderate with average daily temperatures ranging from about 68°F to 81°F. The extreme minimum temperature recorded at the nearby (former) Kahuku weather station is 48°F, while the extreme maximum temperature is 95°F. Average annual rainfall amounts to about 40 inches with summer months being the driest.

Currently, there are no Hawaii Department of Health air monitoring stations located at North Shore or Windward areas of Oahu. All Department of Health air monitoring stations on Oahu are located in leeward areas where there is more human activity and more air pollution emission sources. Data from these stations suggest that all air quality standards are currently being met. Windward areas, such as the project area, very likely have better air quality.

With implementation of the Proposed Action, it may be inevitable that some short- and/or long-term impacts on air quality will occur either directly or indirectly as a consequence of project construction and use. Short-term impacts from fugitive dust will likely occur during the project construction phase. To a lesser extent, exhaust emissions from stationary and mobile construction

equipment, from the disruption of traffic, and from workers' vehicles may also affect air quality during the period of construction. State air pollution control regulations require that there be no visible fugitive dust emissions at the property line. Hence, an effective dust control plan must be implemented to ensure compliance with state regulations. Fugitive dust emissions can be controlled to a large extent by watering of active work areas, using wind screens, keeping adjacent paved roads clean, and by covering of open-bodied trucks. Other dust control measures could include limiting the area that can be disturbed at any given time and/or mulching or chemically stabilizing inactive areas that have been worked. Paving and landscaping of project areas early in the construction schedule will also reduce dust emissions. Monitoring dust at the project boundary during the period of construction could be considered as a means to evaluate the effectiveness of the project dust control program. Exhaust emissions can be mitigated by moving construction equipment and workers to and from the project site during off-peak traffic hours.

After construction, motor vehicles coming to and from the proposed development will result in a long-term increase in air pollution emissions in the project area. To assess the impact of emissions from these vehicles, a computer modeling study was undertaken to estimate current ambient concentrations of carbon monoxide at intersections in the project vicinity and to predict future levels both with and without the Proposed Action. During worst-case conditions, model results indicated that present

1-hour and 8-hour carbon monoxide concentrations are within both the state and the national ambient air quality standards. In the year 2025 without the project, carbon monoxide concentrations were predicted to generally remain about the same in the project area, and worst-case concentrations should remain well within air quality standards. With the Proposed Action or any of the three project alternatives in the year 2025, project-related traffic would result in higher carbon monoxide concentrations compared to the without-project case at some locations, but worst-case concentrations should remain well within air quality standards. The Full Build-Out Alternative would result in the highest concentrations while the Resort Residential the least, although there is not a significant difference. Implementing mitigation measures for traffic-related air quality impacts is probably unnecessary and unwarranted.

Depending on the demand levels, long-term impacts on air quality are also possible due to indirect emissions associated with a development's electrical power and solid waste disposal requirements. Quantitative estimates of these potential impacts were not made, but based on the estimated demand levels and emission rates involved, any impacts from the Proposed Action or any of the three project alternatives will likely be negligible.

2.0 INTRODUCTION

Turtle Bay Resort is proposing the Turtle Bay Resort Expansion

Project at the existing Turtle Bay Resort on the island of Oahu. The project site is located along the North Shore of Oahu at Turtle Bay (see Figure 1 for project location). A Proposed Action, together with three alternatives, is being evaluated. The three alternatives are referred to as: Full Build-Out Alternative, Conservation Partner Alternative and Resort Residential Alternative.

The Proposed Action includes two new hotels totaling 625 units, 590 resort residential units, 160 community housing units, 73 acres of new parks, a new equestrian center, a farmers market, a low-density commercial and cultural activity center and reconfiguration of the two existing golf courses from 36 holes to 27. The Full Build-Out Alternative includes 2,500 new hotel units, 910 resort residential units, and 90 residential housing units. The Conservation Partner Alternative proposes 440 new hotel units, 252 new resort residential units, 48 community housing units and the conversion of the existing Fazio Golf Course to other uses. The Resort Residential Alternative would provide for 500 new residential units and both existing 18-hole golf courses would be retained. It is expected that the Proposed Action or one of the alternatives will be selected for development. The development is expected to be completed and fully occupied by 2025.

The purpose of this study is to describe existing air quality in the project area and to assess the potential short- and long-term direct and indirect air quality impacts that could result from

construction and use of the proposed facilities as planned. Measures to mitigate potential project impacts are suggested where possible and appropriate.

3.0 AMBIENT AIR QUALITY STANDARDS

Ambient concentrations of air pollution are regulated by both national and state ambient air quality standards (AAQS). National AAQS are specified in Section 40, Part 50 of the Code of Federal Regulations (CFR), while State of Hawaii AAQS are defined in Chapter 11-59 of the Hawaii Administrative Rules. Table 1 summarizes both the national and the state AAQS that are specified in the cited documents. As indicated in the table, national and state AAQS have been established for particulate matter, sulfur dioxide, nitrogen dioxide, carbon monoxide, ozone and lead. The state has also set a standard for hydrogen sulfide. National AAQS are stated in terms of both primary and secondary standards for most of the regulated air pollutants. National primary standards are designed to protect the public health with an "adequate margin of safety". National secondary standards, on the other hand, define levels of air quality necessary to protect the public welfare from "any known or anticipated adverse effects of a pollutant". Secondary public welfare impacts may include such effects as decreased visibility, diminished comfort levels, or other potential injury to the natural or man-made environment, e.g., soiling of materials, damage to vegetation or other economic damage. In contrast to the national AAQS, Hawaii State AAQS are given in

terms of a single standard that is designed "to protect public health and welfare and to prevent the significant deterioration of air quality".

Each of the regulated air pollutants has the potential to create or exacerbate some form of adverse health effect or to produce environmental degradation when present in sufficiently high concentration for prolonged periods of time. The AAQS specify a maximum allowable concentration for a given air pollutant for one or more averaging times to prevent harmful effects. Averaging times vary from one hour to one year depending on the pollutant and type of exposure necessary to cause adverse effects. In the case of the short-term (i.e., 1- to 24-hour) AAQS, both national and state standards allow a specified number of exceedances each year.

The Hawaii AAQS are in some cases considerably more stringent than the comparable national AAQS. In particular, the Hawaii 1-hour AAQS for carbon monoxide is four times more stringent than the comparable national limit.

The national AAQS are reviewed periodically, and multiple revisions have occurred over the past 30 years. In general, the national AAQS have become more stringent with the passage of time and as more information and evidence become available concerning the detrimental effects of air pollution. Changes to the Hawaii AAQS over the past several years have tended to follow revisions to the national AAQS, making several of the

Hawaii AAQS the same as the national AAQS.

4.0 REGIONAL AND LOCAL CLIMATOLOGY

Regional and local climatology significantly affects the air quality of a given location. Wind, temperature, atmospheric turbulence, mixing height and rainfall all influence air quality. Although the climate of Hawaii is relatively moderate throughout most of the state, significant differences in these parameters may occur from one location to another. Most differences in regional and local climates within the state are caused by the mountainous topography.

Hawaii lies well within the belt of northeasterly trade winds generated by the semi-permanent Pacific high pressure cell to the north and east. On the island of Oahu, the Koolau and Waianae Mountain Ranges are oriented almost perpendicular to the trade winds, which accounts for much of the variation in the local climatology of the island. The site of the proposed project is located on the windward side of the Koolau Mountains at the northern tip of Oahu near Kahuku Point.

There are no published wind data for this area of Oahu. However, based on the project location and the good exposure to the tradewind flow, ventilation can be expected to be good much of the time. Wind energy resource maps for the Kahuku area [1] suggest that wind speeds are frequently in the upper range. Winds can be expected to come mostly from the east or northeast direction due

to the prevailing tradewind flow and to the local terrain effects.

Air pollution emissions from motor vehicles, the formation of photochemical smog and smoke plume rise all depend in part on air temperature. Colder temperatures tend to result in higher emissions of contaminants from automobiles but lower concentrations of photochemical smog and ground-level concentrations of air pollution from elevated plumes. In Hawaii, the annual and daily variation of temperature depend to a large degree on elevation above sea level, distance inland and exposure to the trade winds. Average temperatures at locations near sea level generally are warmer than those at higher elevations. Areas exposed to the trade winds tend to have the least temperature variation, while inland and leeward areas often have the most. The project's coastal, windward location results in relatively persistent and moderate temperatures. Based on more than 50 years of data collected at the former nearby Kahuku weather station, average annual daily minimum and maximum temperatures in the project area are 68°F and 81°F, respectively [2]. The extreme minimum temperature on record is 48°F, and the extreme maximum is 95°F.

Small scale, random motions in the atmosphere (turbulence) cause air pollutants to be dispersed as a function of distance or time from the point of emission. Turbulence is caused by both mechanical and thermal forces in the atmosphere. It is oftentimes measured and described in terms of Pasquill-Gifford stability class. Stability class 1 is the most turbulent and class 6 the

least. Thus, air pollution dissipates the best during stability class 1 conditions and the worst when stability class 6 prevails. In the Kahuku area, stability class 5 or 6 is generally the highest stability class that occurs, developing during clear, calm nighttime or early morning hours when temperature inversions form due to radiational cooling. Stability classes 1 through 4 occur during the daytime, depending mainly on the amount of cloud cover and incoming solar radiation and the onset and extent of the sea breeze.

Mixing height is defined as the height above the surface through which relatively vigorous vertical mixing occurs. Low mixing heights can result in high ground-level air pollution concentrations because contaminants emitted from or near the surface can become trapped within the mixing layer. In Hawaii, minimum mixing heights tend to be high because of mechanical mixing caused by the trade winds and because of the temperature moderating effect of the surrounding ocean. Low mixing heights may sometimes occur, however, at inland locations and even at times along coastal areas early in the morning following a clear, cool, windless night. Coastal areas also may experience low mixing levels during sea breeze conditions when cooler ocean air rushes in over warmer land. Mixing heights in Hawaii typically are above 3000 feet (1000 meters).

Rainfall can have a beneficial effect on the air quality of an area in that it helps to suppress fugitive dust emissions, and it also may "washout" gaseous contaminants that are water soluble.

Rainfall in Hawaii is highly variable depending on elevation and on location with respect to the trade wind. The Kahuku area receives moderate amounts of precipitation due to its windward and near sea level location. Average annual rainfall amounts to about 40 inches with monthly amounts of about 4 to 5 inches in winter and about 1 to 2 inches in summer [2].

5.0 PRESENT AIR QUALITY

Present air quality in the project area is mostly affected by air pollutants from motor vehicles, agricultural operations and to a lesser extent by natural sources. Table 3 presents an air pollutant emission summary for the island of Oahu for calendar year 1993. This is the most recent information available. The emission rates shown in the table pertain to manmade emissions only, i.e., emissions from natural sources are not included. As suggested in the table, much of the particulate emissions on Oahu originate from area sources, such as the mineral products industry and agriculture. Sulfur oxides are emitted almost exclusively by point sources, such as power plants and refineries. Nitrogen oxides emissions emanate predominantly from industrial point sources, although area sources (mostly motor vehicle traffic) also contribute a significant share. The majority of carbon monoxide emissions occur from area sources (motor vehicle traffic), while hydrocarbons are emitted mainly from point sources. Based on previous emission inventories that have been reported for Oahu, emissions of particulate and nitrogen oxides may have increased during the past several years, while emissions of sulfur oxides,

carbon monoxide and hydrocarbons probably have declined.

Kamehameha Highway, which passes near the project area to the south, is a major arterial roadway that presently carries moderate to heavy levels of vehicle traffic during peak traffic hours. Emissions from motor vehicles using this roadway, primarily nitrogen oxides and carbon monoxide, will tend to be carried away from the project site by the prevailing winds.

Natural sources of air pollution emissions that also could affect the project area but cannot be quantified very accurately include the ocean (sea spray), plants (aero-allergens), wind-blown dust, and perhaps distant volcanoes on the island of Hawaii.

The State Department of Health operates a network of air quality monitoring stations at various locations on Oahu. Each station, however, typically does not monitor the full complement of air quality parameters, and no stations are located on the windward side of the island or anywhere near to the project site. Thus, air quality data from stations at leeward locations will be discussed, but this data is probably only marginally representative of the project area. Table 3 shows annual summaries of air quality measurements that were made at leeward Oahu locations for several of the regulated air pollutants for the period 2006 through 2010. These are the most recent data that are currently available.

During the 2006-2010 period, sulfur dioxide was monitored by the State Department of Health at an air quality station located at Kapolei. Concentrations monitored were consistently low compared to the standards. Annual second-highest 3-hour concentrations (which are most relevant to the air quality standards) ranged from 0.004 to 0.011 parts per million (ppm), while the annual second-highest 24-hour concentrations ranged from 0.003 to 0.004 ppm. Annual average concentrations were only about 0.001 to 0.002 ppm. There were no exceedances of the state/national 3-hour or 24-hour AAQS for sulfur dioxide during the 5-year period. Data pertaining to the new 1-hour standard have not yet been reported.

Particulate matter less than 10 microns in diameter (PM-10) is also measured at the Kapolei monitoring station. Annual second-highest 24-hour PM-10 concentrations ranged from 36 to 58 $\mu g/m^3$ between 2006 and 2010. Average annual concentrations ranged from 16 to 18 $\mu g/m^3$. All values reported were within the state and national AAQS.

Particulate matter less than 2.5 microns in diameter (PM-2.5) measured at the Kapolei monitoring station had annual 98th percentile 24-hour concentrations ranging from 7 to 21 $\mu g/m^3$ between 2006 and 2010. Average annual concentrations ranged from 4 to 6 $\mu g/m^3$. All values reported were within the state and national AAQS.

Carbon monoxide measurements were also made at the Kapolei monitoring station. The annual second-highest 1-hour concentrations ranged from 0.9 to 2.6 ppm. The annual second-highest 8-hour concentrations ranged from 0.7 to 1.2 ppm. These values are well within the standards, and no exceedances of the state or national 1-hour or 8-hour AAQS were reported.

Nitrogen dioxide is also monitored by the Department of Health at the Kapolei monitoring station. Annual average concentrations of this pollutant ranged from 0.003 to 0.005 ppm, safely inside the state and national AAQS.

The nearest available ozone measurements were obtained at Sand Island. The fourth-highest 8-hour concentrations (which are most relevant to the standard) for the period 2006 through 2010 ranged between 0.033 and 0.048 ppm, well inside the state and federal standards. The 8-hour standard for ozone did not exist prior to 2002. Prior to 2002, the now obsolete state 1-hour standard was typically exceeded several times each year.

Although not shown in the table, the nearest and most recent measurements of ambient lead concentrations that have been reported were made at the downtown Honolulu monitoring station between 1996 and 1997. Average quarterly concentrations were near or below the detection limit, and no exceedances of the state AAQS were recorded. Monitoring for this parameter was discontinued during 1997.

It is probable that air pollution concentrations measured at leeward locations are higher than those present on the windward coast where the project is located. Based on the data and discussion presented above, it appears likely that the State of Hawaii AAQS for sulfur dioxide, nitrogen dioxide, particulate matter, ozone and lead are currently being met in the project area. While carbon monoxide measurements at the Kapolei monitoring station suggest that concentrations are within the state and national standards, local "hot spots" may exist near traffic-congested intersections. The potential for this within the specific project area is examined later in this report.

6.0 SHORT-TERM IMPACTS OF PROJECT

Short-term direct and indirect impacts on air quality could potentially occur due to project construction. For a project of this nature, there are two potential types of air pollution emissions that could directly result in short-term air quality impacts during project construction: (1) fugitive dust from vehicle movement and soil excavation; and (2) exhaust emissions from on-site construction equipment. Indirectly, there also could be short-term impacts from slow-moving construction equipment traveling to and from the project site, from a temporary increase in local traffic caused by commuting construction workers, and from the disruption of normal traffic flow caused by lane closures of adjacent roadways.

Fugitive dust emissions may arise from the grading and dirt-moving activities associated with site clearing and preparation work. The emission rate for fugitive dust emissions from construction activities is difficult to estimate accurately. This is because of its elusive nature of emission and because the potential for its generation varies greatly depending upon the type of soil at the construction site, the amount and type of dirt-disturbing activity taking place, the moisture content of exposed soil in work areas, and the wind speed. The EPA [3] has provided a rough estimate for uncontrolled fugitive dust emissions from construction activity of 1.2 tons per acre per month under conditions of "medium" activity, moderate soil silt content (30%), and precipitation/evaporation (P/E) index of 50. Uncontrolled fugitive dust emissions at the project site would likely be somewhere near that level, depending on the amount of rainfall that occurs. In any case, State of Hawaii Air Pollution Control Regulations [4] prohibit visible emissions of fugitive dust from construction activities at the property line. Thus, an effective dust control plan for the project construction phase is essential.

Adequate fugitive dust control can usually be accomplished by the establishment of a frequent watering program to keep bare-dirt surfaces in construction areas from becoming significant sources of dust. In dust-prone or dust-sensitive areas, other control measures such as limiting the area that can be disturbed at any given time, applying chemical soil stabilizers, mulching and/or using wind screens may be necessary. Control regulations further stipulate that open-bodied trucks be covered at all times when in

motion if they are transporting materials that could be blown away. Haul trucks tracking dirt onto paved streets from unpaved areas is often a significant source of dust in construction areas. Some means to alleviate this problem, such as road cleaning or tire washing, may be appropriate. Paving of parking areas and/or establishment of landscaping as early in the construction schedule as possible can also lower the potential for fugitive dust emissions. Monitoring dust at the project property line could be considered to quantify and document the effectiveness of dust control measures.

On-site mobile and stationary construction equipment also will emit air pollutants from engine exhausts. The largest of this equipment is usually diesel-powered. Nitrogen oxides emissions from diesel engines can be relatively high compared to gasoline-powered equipment, but the annual standard for nitrogen dioxide is not likely to be violated by short-term construction equipment emissions. Also, the new short-term (1-hour) standard for nitrogen dioxide is based on a three-year average; thus it is unlikely that relatively short-term construction emissions would exceed the standard. Carbon monoxide emissions from diesel engines are low and should be relatively insignificant compared to vehicular emissions on nearby roadways.

Project construction activities could occasionally obstruct the normal flow of traffic at times to such an extent that overall vehicular emissions in the project area will temporarily increase. The only means to alleviate this problem will be to

attempt to keep roadways open during peak traffic hours and to move heavy construction equipment and workers to and from construction areas during periods of low traffic volume. Thus, most potential short-term air quality impacts from project construction can be mitigated.

7.0 LONG-TERM IMPACTS OF PROJECT

7.1 Roadway Traffic

After construction is completed, use of the proposed facilities will result in increased motor vehicle traffic in the project area, potentially causing long-term impacts on ambient air quality. Motor vehicles with gasoline-powered engines are significant sources of carbon monoxide. They also emit nitrogen oxides and other contaminates.

Federal air pollution control regulations require that new motor vehicles be equipped with emission control devices that reduce emissions significantly compared to a few years ago. In 1990, the President signed into law the Clean Air Act Amendments. This legislation required further emission reductions, which have been phased in since 1994. Additional restrictions were signed into law during the Clinton administration, and these began to take effect during the past decade. The added restrictions on emissions from new motor vehicles will lower average emissions each year as more and more older vehicles leave the state's roadways. It is estimated that carbon monoxide emissions, for

example, will go down by an average of about 20 percent per vehicle during the next 10 years due to the replacement of older vehicles with newer models.

To evaluate the potential long-term indirect ambient air quality impact of increased roadway traffic associated with a project such as this, computerized emission and atmospheric dispersion models can be used to estimate ambient carbon monoxide concentrations along roadways leading to and from the project. Carbon monoxide is selected for modeling because it is both the most stable and the most abundant of the pollutants generated by motor vehicles. Furthermore, carbon monoxide air pollution is generally considered to be a microscale problem that can be addressed locally to some extent, whereas nitrogen oxides air pollution most often is a regional issue that cannot be addressed by a single new development.

For this project, six scenarios were selected for the carbon monoxide modeling study: (1) year 2012 with present conditions, (2) year 2025 without the project, (3) year 2025 with the project Conservation Partner Alternative, (4) year 2025 with the project Full Build-Out Alternative, (5) year 2025 with the Proposed Action, and (6) year 2025 with the project Resort Residential Alternative. To begin the modeling study of the six scenarios, critical receptor areas in the vicinity of the project were identified for analysis. Generally speaking, roadway intersections are the primary concern because of traffic congestion and because of the increase in vehicular emissions

associated with traffic queuing. For this study, the key intersections identified in the traffic study were also selected for air quality analysis. These included the following intersections:

- Kamehameha Highway at Kuilima Drive
- Kamehameha Highway at Marconi Road
- Kamehameha Highway at Kaihalulu Drive (the project's new lateral roadway)

The traffic impact report for the project [5] describes the existing and the projected future traffic conditions and laneage configurations of these intersections in detail. In performing the air quality impact analysis, it was assumed that all recommended traffic mitigation measures would be implemented.

The main objective of the modeling study was to estimate maximum 1-hour average carbon monoxide concentrations for each of the four scenarios studied. To evaluate the significance of the estimated concentrations, a comparison of the predicted values for each scenario can be made. Comparison of the estimated values to the national and state AAQS was also used to provide another measure of significance.

Maximum carbon monoxide concentrations typically coincide with peak traffic periods. The traffic impact assessment report evaluated weekday morning, weekday afternoon and Saturday peak traffic periods. These same periods were evaluated in the air

quality impact assessment.

The EPA computer model MOBILE6.2 [6] was used to calculate vehicular carbon monoxide emissions for each year studied. One of the key inputs to MOBILE6.2 is vehicle mix. Unless very detailed information is available, national average values are typically assumed, which is what was used for the present study. Based on national average vehicle mix figures, the present vehicle mix in the project area was estimated to be 33.2% light-duty gasoline-powered automobiles, 53.9% light-duty gasoline-powered trucks and vans, 3.6% heavy-duty gasoline-powered vehicles, 0.2% light-duty diesel-powered vehicles, 8.6% heavy-duty diesel-powered trucks and buses, and 0.5% motorcycles. For the future scenarios studied, the vehicle mix was estimated to change slightly with fewer light-duty gasoline-powered automobiles and more light-duty gasoline-powered trucks and vans. This reflects the nationwide trend of driver preferences in motor vehicles.

Ambient temperatures of 59 and 68 degrees F were used for morning and afternoon peak-hour emission computations, respectively. These are conservative assumptions since morning/afternoon ambient temperatures will generally be warmer than this, and emission estimates given by MOBILE6.2 generally have an inverse relationship to the ambient temperature.

After computing vehicular carbon monoxide emissions through the use of MOBILE6.2, these data were then input to an atmospheric dispersion model. EPA air quality modeling guidelines [7]

currently recommend that the computer model CAL3QHC [8] be used to assess carbon monoxide concentrations at roadway intersections, or in areas where its use has previously been established, CALINE4 [9] may be used. CALINE4 was used extensively in Hawaii in the 1990's to assess air quality impacts at roadway intersections, but in December 1997, the California Department of Transportation recommended that the intersection mode of CALINE4 no longer be used because it was thought the model had become outdated. Studies have shown that CALINE4 may tend to over-predict maximum concentrations in some situations. For the past several years, CAL3QHC has been used in Hawaii to assess air quality impacts near roadway intersections, and therefore, CAL3QHC was used for the subject analysis.

CAL3QHC was developed for the U.S. EPA to simulate vehicular movement, vehicle queuing and atmospheric dispersion of vehicular emissions near roadway intersections. It is designed to predict 1-hour average pollutant concentrations near roadway intersections based on input traffic and emission data, roadway/receptor geometry and meteorological conditions.

Although CAL3QHC is intended primarily for use in assessing atmospheric dispersion near signalized roadway intersections, it can also be used to evaluate unsignalized intersections. This is accomplished by manually estimating queue lengths and then applying the same techniques used by the model for signalized intersections. Currently, the two existing study intersection

(Kamehameha Highway at Kuilima Drive and Kamehameha Highway at Marconi Road) are unsignalized. For the future without project scenario, in accordance with the traffic report, these intersections were assumed to remain unsignalized. For the future scenarios with the project, in accordance with the traffic report, these intersections, as well as a new intersection at Kamehameha Highway and Kaihalulu Drive, were assumed to become signalized.

Input peak-hour traffic data were obtained from the traffic study cited previously. This included vehicle approach volumes, saturation capacity estimates, intersection laneage and signal timings (where applicable). All emission factors that were input to CAL3QHC for free-flow traffic on roadways were obtained from MOBILE6.2 based on assumed free-flow vehicle speeds corresponding to the posted speed limits.

Model roadways were set up to reflect roadway geometry, physical dimensions and operating characteristics. Concentrations predicted by air quality models generally are not considered valid within the roadway-mixing zone. The roadway-mixing zone is usually taken to include 3 meters on either side of the traveled portion of the roadway and the turbulent area within 10 meters of a cross street. Model receptor sites were thus located at the edges of the mixing zones near all intersections that were studied for all scenarios. All receptor heights were placed at 1.8 meters above ground to simulate levels within the normal human breathing zone.

Input meteorological conditions for this study were defined to provide "worst-case" results. One of the key meteorological inputs is atmospheric stability category. For these analyses, atmospheric stability category 6 was assumed for the weekday morning cases, while atmospheric stability category 4 was assumed for the weekday and Saturday afternoon cases. These are the most conservative stability categories that are generally used for estimating worst-case pollutant dispersion within suburban areas for these periods. A surface roughness length of 100 cm and a mixing height of 1000 meters were used in all cases. Worst-case wind conditions were defined as a wind speed of 1 meter per second with a wind direction resulting in the highest predicted concentration. Concentration estimates were calculated at wind directions of every 5 degrees.

Existing background concentrations of carbon monoxide in the project vicinity are believed to be at low levels. Thus, background contributions of carbon monoxide from sources or roadways not directly considered in the analysis were accounted for by adding a background concentration of 0.5 ppm to all predicted concentrations for 2012. Although increased traffic is expected to occur within the project area during the next several years with or without the project, background carbon monoxide concentrations may not change significantly since individual emissions from motor vehicles are forecast to decrease with time. Hence, a background value of 0.5 ppm was assumed to persist for the future scenarios studied.

Predicted Worst-Case 1-Hour Concentrations

Table 4 summarizes the final results of the modeling study in the form of the estimated worst-case 1-hour morning and afternoon ambient carbon monoxide concentrations. These results can be compared directly to the state and the national AAQS. Estimated worst-case carbon monoxide concentrations are presented in the table for six scenarios: year 2012 with existing traffic, year 2025 without the project, year 2025 with the Proposed Action, year 2025 with the project Full Build-Out Alternative, year 2025 with the project Conservation Partner Alternative and year 2025 with the project Resort Residential Alternative. The locations of these estimated worst-case 1-hour concentrations all occurred at or very near the indicated intersections.

As indicated in the table, the highest estimated 1-hour concentration within the project vicinity for the present (2012) case was 1.7 ppm. This was projected to occur during both the weekday morning peak traffic hour and the Saturday peak traffic period near the intersection of Kamehameha Highway and Kuilima Drive. Concentrations at other locations and times studied were 1.3 ppm or lower. All predicted worst-case 1-hour concentrations for the 2012 scenario were within both the national AAQS of 35 ppm and the state standard of 9 ppm.

In the year 2025 without the proposed project, the highest worst-case 1-hour concentration was predicted to occur during the Saturday peak traffic hour at the intersection of Kamehameha

Highway and Kuilima Drive. A value of 1.8 ppm was predicted to occur at this location and time. Peak-hour worst-case values at the other locations and times studied for the 2025 without project scenario ranged between 1.0 and 1.6 ppm. Compared to the existing case, concentrations generally remained about the same, and all projected worst-case concentrations for this scenario remained well within the state and national standards.

In the year 2025, the full build-out alternative was predicted to result in the highest worst-case 1-hour concentration. This was predicted to occur during the weekday morning at the intersection of Kamehameha Highway and Kuilima Drive with a value of 3.1 ppm. Other concentrations for this alternative ranged between 2.0 and 2.9 ppm. The Proposed Action and other project alternatives generally resulted in slightly lower concentrations, but the difference amongst them was relatively small. Although the predicted concentrations with any development increased compared to the without project scenario, the values remained well within the state and federal standards.

Predicted Worst-Case 8-Hour Concentrations

Worst-case 8-hour carbon monoxide concentrations were estimated by multiplying the worst-case 1-hour values by a persistence factor of 0.5. This accounts for two factors: (1) traffic volumes averaged over eight hours are lower than peak 1-hour values, and (2) meteorological conditions are more variable (and hence more favorable for dispersion) over an 8-hour period than they are for

a single hour. Based on monitoring data, 1-hour to 8-hour persistence factors for most locations generally vary from 0.4 to 0.8 with 0.6 being the most typical. One study based on modeling [10] concluded that 1-hour to 8-hour persistence factors could typically be expected to range from 0.4 to 0.5. EPA guidelines [11] recommend using a value of 0.7 unless a locally derived persistence factor is available. Recent monitoring data for locations on Oahu reported by the Department of Health [12] suggest that this factor may range between about 0.2 and 0.6 depending on location and traffic variability. Considering the location of the project and the traffic pattern for the area, a 1-hour to 8-hour persistence factor of 0.5 will likely yield reasonable estimates of worst-case 8-hour concentrations.

The resulting estimated worst-case 8-hour concentrations are indicated in Table 5. For the 2012 scenario, the estimated worst-case 8-hour carbon monoxide concentrations for the two locations studied were 0.6 ppm at the Kamehameha Highway/Marconi Road intersection and 0.8 ppm at the Kamehameha Highway/Kuilima Drive intersection. The estimated worst-case concentrations for the existing case were within both the state standard of 4.4 ppm and the national limit of 9 ppm.

For the year 2025 without project scenario, worst-case concentrations ranged between 0.6 and 0.9 ppm, with the highest concentration occurring at Kamehameha Highway and Kuilima Drive. All predicted concentrations were within the standards.

For the 2025 with Proposed Action or alternatives, worst-case concentrations were predicted to increase somewhat compared to the without project case. At the three intersections studied, predicted worst-case concentrations ranged from 1.0 to 1.6 ppm with the highest concentration occurring at the intersection of Kamehameha Highway and Kaihalulu Drive in the Full Build-Out Alternative. All predicted 8-hour concentrations for the Proposed Action and alternatives were within both the national and the state AAQS.

Conservativeness of Estimates

The results of this study reflect several assumptions that were made concerning both traffic movement and worst-case meteorological conditions. One such assumption concerning worst-case meteorological conditions is that a wind speed of 1 meter per second with a steady direction for 1 hour will occur. A steady wind of 1 meter per second blowing from a single direction for an hour is extremely unlikely and may occur only once a year or less. With wind speeds of 2 meters per second, for example, computed carbon monoxide concentrations would be only about half the values given above. The 8-hour estimates are also conservative in that it is unlikely that anyone would occupy the assumed receptor sites (within 3 m of the roadways) for a period of 8 hours.

7.2 Electrical Demand

The Proposed Action also will cause indirect air pollution emissions from power generating facilities as a consequence of electrical power usage. T**he estimated annual electrical demands of the Proposed Action and alternatives are shown in Table 6. The highest electrical demand, 107 million kilowatt-hours per year, would occur with the Full Build-Out Alternative, while the Resort Residential Alternative would have the least at 31 million kilowatt-hours per year.** Electrical power for the development will most probably be provided mainly by oil-fired generating facilities located on Oahu, but some of the power could also come from sources burning other fuels, such as H-Power and the AES coal-fired power plant at Campbell Industrial Park, or from renewable energy resources that are currently being developed. In order to meet the electrical power needs of the Proposed Action, power generating facilities may be required to burn more fuel and hence more air pollution may be emitted at these facilities. Table 7 presents estimates of the indirect air pollution emissions that would result from the Proposed Action’s electrical demand assuming all power is provided by burning more fuel oil at Oahu's power plants. These values can be compared to the island-wide emission estimates for 1993 given in Table 3. The Full Build-Out Alternative would have the highest emissions, while the Resort Residential Alternative would have the least. The Proposed Action or alternatives would result in relatively small emissions from project electrical demand. The estimated indirect emissions from the electrical

demand amounts to less than 0.1 percent of the present air pollution emissions occurring on Oahu.

7.3 Solid Waste Disposal

Solid waste generated by the Proposed Action or alternatives is not expected to exceed the amounts indicated in Table 8. As indicated in the table, the estimated amounts assume 70 percent recycling/reuse diversion. Most project refuse will likely be hauled away and burned at the H-Power facility at Campbell Industrial Park to generate electricity. Burning of the waste to generate electricity will result in emissions of particulate, carbon monoxide and other contaminants, but these will be offset to some extent by reducing the amount of fuel oil that may be required to generate electricity for the project. Table 9 gives emission estimates assuming all project solid waste is burned at H-Power. These values can be compared to the island-wide emission estimates for 1993 given in Table 2. The estimated potential indirect emissions from project solid waste disposal demand amount to less than 0.1 percent of the present air pollution emissions occurring on Oahu. The emissions from the Proposed Action or alternatives are relatively small. The Full Build-Out Alternative would result in the most emissions and the Resort Residential Alternative the least.

8.0 CONCLUSIONS AND RECOMMENDATIONS

The major potential short-term air quality impact of the project

will occur from the emission of fugitive dust during construction. Uncontrolled fugitive dust emissions from construction activities are estimated to amount to about 1.2 tons per acre per month, depending on rainfall. To control dust, active work areas and any temporary unpaved work roads should be watered at least twice daily on days without rainfall. Use of wind screens and/or limiting the area that is disturbed at any given time will also help to contain fugitive dust emissions. Wind erosion of inactive areas of the site that have been disturbed could be controlled by mulching or by the use of chemical soil stabilizers. Dirt-hauling trucks should be covered when traveling on roadways to prevent windage. A routine road cleaning and/or tire washing program will also help to reduce fugitive dust emissions that may occur as a result of trucks tracking dirt onto paved roadways in the project area. Paving of parking areas and establishment of landscaping early in the construction schedule will also help to control dust. Monitoring dust at the project boundary during the period of construction could be considered as a means to evaluate the effectiveness of the project dust control program and to adjust the program if necessary.

During construction phases, emissions from engine exhausts (primarily consisting of carbon monoxide and nitrogen oxides) will also occur both from on-site construction equipment and from vehicles used by construction workers and from trucks traveling to and from the project. Increased vehicular emissions due to disruption of traffic by construction equipment and/or commuting construction workers can be alleviated by moving equipment and

personnel to the site during off-peak traffic hours.

After construction of the Proposed Action or alternative is completed and fully occupied, carbon monoxide concentrations in the project area will likely increase due to emissions from project-related motor vehicle traffic. The Full Build-Out Alternative would likely have the most impact, while the Resort Residential Alternative the least, but worst-case concentrations should remain within both the state and the national ambient air quality standards with the Proposed Action or any of the three project alternatives studied. Implementing any air quality mitigation measures for long-term traffic-related impacts is probably unnecessary and unwarranted.

Any long-term impacts on air quality due to indirect emissions from supplying the project with electricity and from the disposal of waste materials generated by the project will likely be negligible based on the magnitudes of the estimated emissions compared to the current island-wide emissions.

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Figure 1 - Project Location

Table 1

SUMMARY OF STATE OF HAWAII AND NATIONAL AMBIENT AIR QUALITY STANDARDS

Pollutant	Units	Averaging Time	Maximum Allowable Concentration		
			National Primary	National Secondary	State of Hawaii
Particulate Matter (<10 microns)	$\mu g/m^3$	Annual	-	-	50
		24 Hours	150[a]	150[a]	150[b]
Particulate Matter (<2.5 microns)	$\mu g/m^3$	Annual	15[c]	15[c]	-
		24 Hours	35[d]	35[d]	-
Sulfur Dioxide	ppm	Annual	-	-	0.03
		24 Hours	-	-	0.14[b]
		3 Hours	-	0.5[b]	0.5[b]
		1 Hour	0.075[e]	-	-
Nitrogen Dioxide	ppm	Annual	0.053	0.053	0.04
		1 Hour	0.100[f]	-	-
Carbon Monoxide	ppm	8 Hours	9[b]	-	4.4[b]
		1 Hour	35[b]	-	9[b]
Ozone	ppm	8 Hours	0.075[g]	0.075[g]	0.08[g]
Lead	$\mu g/m^3$	3 Months	0.15[h]	0.15[h]	-
		Quarter	1.5[i]	1.5[i]	1.5[i]
Hydrogen Sulfide	ppm	1 Hour	-	-	0.035[b]

[a] Not to be exceeded more than once per year on average over three years.
[b] Not to be exceeded more than once per year.
[c] Three-year average of the weighted annual arithmetic mean.
[d] 98th percentile value of the 24-hour concentrations averaged over three years.
[e] Three-year average of annual fourth-highest daily 1-hour maximum.
[f] 98th percentile value of the daily 1-hour maximum averaged over three years.
[g] Three-year average of annual fourth-highest daily 8-hour maximum.
[h] Rolling 3-month average.
[i] Quarterly average.

Table 2

AIR POLLUTION EMISSIONS INVENTORY FOR ISLAND OF OAHU, 1993

Air Pollutant	Point Sources (tons/year)	Area Sources (tons/year)	Total (tons/year)
Particulate	25,891	49,374	75,265
Sulfur Oxides	39,230	nil	39,230
Nitrogen Oxides	92,436	31,141	123,577
Carbon Monoxide	28,757	121,802	150,559
Hydrocarbons	4,160	421	4,581

Source: Final Report, "Review, Revise and Update of the Hawaii Emissions Inventory Systems for the State of Hawaii", prepared for Hawaii Department of Health by J.L. Shoemaker & Associates, Inc., 1996

Table 3

ANNUAL SUMMARIES OF AIR QUALITY MEASUREMENTS FOR MONITORING STATIONS NEAREST TURTLE BAY EXPANSION PROJECT

Parameter / Location	2006	2007	2008	2009	2010
Sulfur Dioxide / Kapolei					
3-Hour Averaging Period:					
Highest Concentration (ppm)	0.005	0.010	0.009	0.010	0.012
2nd Highest Concentration (ppm)	0.004	0.008	0.009	0.007	0.011
No. of State AAQS Exceedances	0	0	0	0	0
24-Hour Averaging Period:					
Highest Concentration (ppm)	0.003	0.003	0.005	0.003	0.004
2nd Highest Concentration (ppm)	0.003	0.003	0.003	0.003	0.004
No. of State AAQS Exceedances	0	0	0	0	0
Annual Average Concentration (ppm)	0.002	0.002	0.001	0.001	0.001
Particulate (PM-10) / Kapolei					
24-Hour Averaging Period:					
Highest Concentration ($\mu g/m^3$)	59	75(a)	61	37	59
2nd Highest Concentration ($\mu g/m^3$)	58	57	44	36	58
No. of State AAQS Exceedances	0	0	0	0	0
Annual Average Concentration ($\mu g/m^3$)	16	17	18	16	16
Particulate (PM-2.5) / Kapolei					
24-Hour Averaging Period:					
Highest Concentration ($\mu g/m^3$)	34(a)	20	35	25	61(a)
98th percentile Concentration ($\mu g/m^3$)	7	8	21	13	12
No. of State AAQS Exceedances	0	0	0	0	1(a)
Annual Average Concentration ($\mu g/m^3$)	4	4	5	6	4
Carbon Monoxide / Kapolei					
1-Hour Averaging Period:					
Highest Concentration (ppm)	1.4	3.8	2.2	3.7	1.6
2nd Highest Concentration (ppm)	1.4	0.9	1.7	2.6	1.5
No. of State AAQS Exceedances	0	0	0	0	0
8-Hour Averaging Period:					
Highest Concentration (ppm)	1.0	0.8	0.7	1.2	1.0
2nd Highest Concentration (ppm)	1.0	0.7	0.7	1.2	0.8
No. of State AAQS Exceedances	0	0	0	0	0
Nitrogen Dioxide / Kapolei					
Annual Average Concentration (ppm)	0.005	0.005	0.004	0.004	0.003
Ozone / Sand Island					
8-Hour Averaging Period:					
Highest Concentration (ppm)	0.042	0.035	0.048	0.049	0.052
4th Highest Concentration (ppm)	0.042	0.033	0.043	0.048	0.047
No. of State AAQS Exceedances	0	0	0	0	0

(a) Data flagged due to fireworks. SOURCE: STATE OF HAWAII DEPARTMENT OF HEALTH, "ANNUAL SUMMARIES" HAWAII AIR QUALITY DATA, 2006 - 2010"

Table 4

ESTIMATED WORST-CASE 1-HOUR CARBON MONOXIDE CONCENTRATIONS ALONG ROADWAYS NEAR TURTLE BAY EXPANSION PROJECT (parts per million)

Roadway Intersection	Year/Scenario								
	2012/Present			2025/Without Project			2025/Proposed Action		
	AM	PM	Sat.	AM	PM	Sat.	AM	PM	Sat.
Kamehameha Highway at Kuilima Drive	1.7	1.3	1.7	1.6	1.4	1.8	2.4	1.9	2.1
Kamehameha Highway at Marconi Road	1.3	1.0	1.0	1.3	1.0	1.1	2.1	1.6	2.2
Kamehameha Highway at Kaihalulu Drive	-	-	-	-	-	-	2.6	1.6	2.0

Hawaii State AAQS: 9
National AAQS: 35

(Continued)

Table 4 (cont.)

ESTIMATED WORST-CASE 1-HOUR CARBON MONOXIDE CONCENTRATIONS ALONG ROADWAYS NEAR TURTLE BAY EXPANSION PROJECT (parts per million)

Roadway Intersection	Year/Scenario								
	2025/Full Build-Out			2025/Conservation Partner			2025/Resort Residential		
	AM	PM	Sat.	AM	PM	Sat.	AM	PM	Sat.
Kamehameha Highway at Kuilima Drive	2.9	2.1	2.2	2.2	1.7	2.0	2.2	1.6	2.0
Kamehameha Highway at Marconi Road	2.7	2.0	2.2	1.9	1.3	1.7	1.9	1.3	1.7
Kamehameha Highway at Kaihalulu Drive	3.1	2.6	2.4	2.4	1.5	2.0	2.0	1.4	1.8

Hawaii State AAQS: 9
National AAQS: 35

Table 5

ESTIMATED WORST-CASE 8-HOUR CARBON MONOXIDE CONCENTRATIONS ALONG ROADWAYS NEAR TURTLE BAY EXPANSION PROJECT (parts per million)

Roadway Intersection	Year/Scenario		
	2012/Present	2025/Without Project	2025/Proposed Action
Kamehameha Highway at Kuilima Drive	0.8	0.9	1.2
Kamehameha Highway at Marconi Road	0.6	0.6	1.1
Kamehameha Highway at Kaihalulu Drive	-	-	1.3

Hawaii State AAQS: 4.4
National AAQS: 9

(Continued)

Table 5 (cont.)

ESTIMATED WORST-CASE 8-HOUR CARBON MONOXIDE CONCENTRATIONS ALONG ROADWAYS NEAR TURTLE BAY EXPANSION PROJECT (parts per million)

Roadway Intersection	Year/Scenario		
	2025/Full Build-Out	2025/Conservation Partner	2025/Resort Residential
Kamehameha Highway at Kuilima Drive	1.4	1.1	1.1
Kamehameha Highway at Marconi Road	1.4	1.0	1.0
Kamehameha Highway at Kaihalulu Drive	1.6	1.2	1.0

Hawaii State AAQS: 4.4
National AAQS: 9

Table 6

ESTIMATED ANNUAL ELECTRICAL DEMAND FOR TURTLE BAY EXPANSION PROJECT

Project	Estimated Annual Electrical Demand (million kilowatt-hours
Proposed Action	70
Full Build-Out Alternative	107
Conservation Partner Alternative	46
Resort Residential Alternative	31

Source: Personal communication via email from Cheryl Palesh, Belt Collins Hawaii LLC, to Barry D. Neal, B.D. Neal & Associates, Turtle Bay Resort Monthly Electrical Demand Estimates, August 22, 2012.

Table 7

ESTIMATED INDIRECT AIR POLLUTION EMISSIONS FROM TURTLE BAY EXPANSION PROJECT ELECTRICAL DEMAND[a]

Air Pollutant	Emission Rate (tons/year)			
	Proposed Action	Full Build-Out	Conservation Partner	Resort Residential
Particulate	2	3	1	1
Sulfur Dioxide	24	36	16	11
Carbon Monoxide	2	3	1	1
Volatile Organics	1	1	<1	<1
Nitrogen Oxides	10	16	7	4

[a]Based on U.S. EPA emission factors for utility boilers [3]. Assumes electrical demand indicated in Table 6 and low-sulfur oil used to generate power.

Table 8

ESTIMATED ANNUAL SOLID WASTE DISPOSAL DEMAND FOR TURTLE BAY EXPANSION PROJECT

Project	Estimated Annual Solid Waste Disposal Demand (tons)[a]
Proposed Action	2,626
Full Build-Out Alternative	3,686
Conservation Partner Alternative	1,173
Resort Residential Alternative	1,106

[a]Assumes 70 percent recycling/reuse diversion.

Source: Personal communication via email from Lee Sichter, Lee Sichter LLC, to Barry D. Neal, B.D. Neal & Associates, Turtle Bay Resort Annual Solid Waste Disposal Demand Estimates, August 14, 2012.

Table 9

ESTIMATED INDIRECT AIR POLLUTION EMISSIONS FROM TURTLE BAY EXPANSION PROJECT SOLID WASTE DISPOSAL DEMAND[a]

Air Pollutant	Emission Rate (tons/year)			
	Proposed Action	Full Build-Out	Conservation Partner	Resort Residential
Particulate	0.2	0.2	0.1	0.1
Sulfur Dioxide	0.6	0.8	0.2	0.2
Carbon Monoxide	2.5	3.5	1.1	1.1
Nitrogen Oxides	6.6	9.2	2.9	2.8
Lead	0.3	0.4	0.1	0.1

[a]Assumes solid waste disposal demands indicated in Table 8 and that solid waste is burned in a refuse-derived fuel-fired power plant equipped with spray dryer and fabric filter. Emission rates based on U.S. EPA emission factors for refuse-derived fuel-fired combustors [3].

I

APPENDIX I: (revised)

TRAFFIC IMPACT ANALYSIS REPORT

REVISED TRAFFIC IMPACT ANALYSIS REPORT

FOR THE PROPOSED

TURTLE BAY RESORT MASTER PLAN

KAHUKU, OAHU, HAWAII

PREPARED FOR

TURTLE BAY RESORT, LLC

PREPARED BY

THE TRAFFIC MANAGEMENT CONSULTANT

REVISED TRAFFIC IMPACT ANALYSIS REPORT

FOR THE PROPOSED

TURTLE BAY RESORT MASTER PLAN

KAHUKU, OAHU, HAWAII

PREPARED FOR

TURTLE BAY RESORT, LLC

~~NOVEMBER, 2012~~ MAY, 2013

RANDALL S. OKANEKU
LICENSED PROFESSIONAL ENGINEER
No. 4922-C
HAWAII, U.S.A.

THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION.

SIGNATURE — EXPIRATION DATE OF LICENSE: 04/30/2014

PREPARED BY

THE TRAFFIC MANAGEMENT CONSULTANT

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TRAFFIC IMPACT ANALYSIS REPORT
FOR THE PROPOSED
TURTLE BAY RESORT MASTER PLAN
KAHUKU, OAHU, HAWAII

I. Introduction

A. Retrospective on the Master Planning of the Turtle Bay Resort

The master planning of the expansion of the Turtle Bay Resort has spanned almost 30 years. The traffic impacts of the Turtle Bay Resort Master Plan have been documented in several studies, which are summarized as follows.

The 1985 Traffic Impact Report for the Proposed Turtle Bay Resort, dated June, 1985, was prepared by Austin, Tsutsumi & Associates, Inc., and was incorporated into the Revised Environmental Impact Statement for the Kuilima Resort Expansion, dated October, 1985 (1985 EIS).

An update of the 1985 EIS traffic study entitled, Traffic Impact Analysis Report for the Proposed Kuilima Resort Expansion, was prepared by The Traffic Management Consultant (TMC), dated July 25, 1991. The 1991 traffic study focused on the access to the Resort.

A subsequent update entitled, the Traffic Impact Analysis Report Update for the Proposed Turtle Bay Resort Master Plan (TIAR Update) was prepared by The Traffic Management Consultant, dated September 9, 2005. The purpose of the TIAR Update was to support the design of the proposed Turtle Bay Resort access intersections along Kamehameha Highway.

TMC prepared Addendum No. 1 to the 2005 TIAR Update, dated February 14, 2006, to analyze the channelization design of the intersection of Kamehameha Highway and Kaihalulu Drive (formerly known as Alpha Road and West Kuilima Drive).

At the request of the City and County of Honolulu Department of Planning and Permitting (DPP), TMC prepared Addendum No. 2 of the 2005 TIAR Update, dated April

21, 2006, to determine if and when Kaihalulu Drive should be widened from two lanes to four lanes.

TMC prepared Addendum No. 3 to the 2005 TIAR Update, dated August 25, 2006, to analyze a second phase of improvements on Kamehameha Highway at the Kaihalulu Drive intersection, and at the Kuilima Drive intersection.

TMC prepared Addendum No. 4 to the 2005 TIAR Update, dated June 27, 2007, to determine the first phase of development, where access would be provided by the improved intersection of Kamehameha Highway and Kuilima Drive.

The 2009 Revised Traffic Impact Analysis Report Update for the Proposed Turtle Bay Resort Master Plan (Revised TIAR Update) was prepared by The Traffic Management Consultant, dated April 16, 2009. The Revised TIAR Update was formally accepted by the State of Hawaii Department of Transportation (DOT) in their letter dated July 9, 2009.

The traffic studies from 1985 through 2009 were all based upon the same overall density for the Turtle Bay Resort Master Plan, i.e., a total of 3,500 new hotel rooms and resort residential units, as approved by Zoning Ordinance. The current Turtle Bay Resort Master Plan is the first effort to significantly reduce the Resort density to 1,375 new hotel rooms (which excludes the existing Turtle Bay Hotel and Ocean Villas), resort residential units (which excludes the existing Kuilima Estates), and community housing units.

In the preparation for this current Traffic Impact Analysis Report, Turtle Bay Resort, LLC and its consultants worked extensively with the State of Hawaii Department of Transportation staff to establish the scope, study area, methodology, and guidelines of this study.

B. Purpose and Scope

The purpose of this traffic study is to analyze the traffic impacts that may result from the development of the Turtle Bay Resort Master Plan, hereinafter referred to as the "Proposed Action" and three (3) Alternatives. This report presents the findings and recommendations of the study. The scope of this study includes:

1. The description of the Proposed Action and the three (3) Alternatives.

2. Traffic count surveys during the weekday and weekend on Kamehameha Highway in the study area, which extends from Turtle Bay Resort west to Haleiwa and east to Kahaluu.

3. An evaluation of the traffic count survey data to establish existing traffic conditions within the study area.

4. The development of the trip generation characteristics for the Proposed Action and the three (3) Alternatives for Turtle Bay Resort.

5. Identification and analysis of the traffic impactsresulting from the full build out and occupancy of the Proposed Action and the three (3) Alternatives.

6. The development and evaluation of traffic improvements, which would mitigate the traffic impacts identified in this study

C. Methodologies

1. Capacity Analysis Methodology

The highway capacity analysis, performed for this study, is based upon procedures presented in the Highway Capacity Manual (HCM), published by the Transportation Research Board, 2010. HCM defines Level of Service (LOS) as "a quality measure describing operational conditions within a traffic stream". Several factors are considered in determining LOS, such as: speed, travel time, freedom to maneuver, traffic interruptions, driver comfort, and convenience. LOS's "A", "B", and "C" are considered satisfactory Levels of Service. LOS "D" is generally considered a "desirable minimum" operating level of service. LOS "E" is an undesirable condition, and LOS "F" is an unacceptable condition.

The Level of Service for a two-lane highway are defined by HCM for three (3) classes of highway. The Class II highway applies to most of Kamehameha Highway in the study area. Class II highways are defined as scenic or recreational routes, where speeds are moderate. The Levels of Service for a Class II two-lane highway are based upon the Percent Time-Spent-Following (PTSF). PTSF is a measure of restricted traffic flows or "platoon" flows, i.e., groups of vehicles following slow-moving vehicles, combined with limited opportunities for passing. Passing opportunities are affected by sight distance limitations and the volume of opposing traffic. As a result, the lower LOS on a Class II two-lane highway can result from low traffic flow relative to the high PTSF.

Intersection LOS is based primarily on average vehicle delay, which is expressed in terms of seconds per vehicle (sec/veh). The LOS delays at a signalized intersection are generally higher than at a stop-controlled intersection due to user expectations. A motorist will tolerate longer delays at signalized intersections, which are generally located on high volume facilities. Stop-controlled intersections are located on lower volume roadways where delay is less predictable, which reduces the driver's tolerance for delay. Table 1 summarizes the LOS criteria.

Table 1. Level of Service Criteria (HCM)			
LOS	**Two-Lane Highway (Class II)**	**Intersection Delay**	
	PTSF (%)	**Signalized Control (sec/veh)**	**Stop-Control (sec/veh)**
A	≤ 35	≤ 10	≤ 10
B	> 35 – 50	> 10 – 20	> 10 – 15
C	> 50 – 65	> 20 – 35	> 15 – 25
D	> 65 – 80	> 35 – 55	> 25 – 35
E	> 80	> 55 – 80	> 35 – 50
F	(volume exceeds capacity)	> 80	> 50

"Volume-to-capacity" (v/c) ratio is another measure of effectiveness, which indicates the relative traffic demand to the roadway's capacity. HCM defines capacity as "the maximum number of vehicles that can pass a given point during a specified period under prevailing roadway, traffic flow, and traffic control conditions." A v/c ratio of 0.50 indicates that the traffic demand is utilizing 50 percent of the roadway's capacity. A v/c ratio in excess of 1.00 indicates that the traffic demand exceeds the capacity of the highway facility. The v/c ratio may be more indicative of the facility utilization in the case of Kamehameha Highway, since it compares traffic demand with the highway capacity. While LOS represents the traffic operations of the two-lane highway, where slow-moving vehicles can increase the platooning effect and affect operating speeds. Worksheets for the capacity analysis, performed throughout this report, are presented in the Appendix.

2. Traffic Simulation

SimTraffic is a traffic simulation software, which is developed by Trafficware Corporation. Traffic simulation is a stochastic process, which can analyze the interactions of individual vehicles on a roadway network over time. SimTraffic was used to analyze the vehicle queuing and the overall operations of the arterial network. The recommended left-turn storage lengths were based upon the 95th percentile queue lengths, which were determined by averaging ten (10) SimTraffic simulations during the peak hour of traffic. Where HCM analysis yielded unrealistic results, SimTraffic was used to verify the traffic analysis.

3. Traffic Signal Warrant Analysis

Traffic signal warrant analyses were prepared for the intersection of Kamehameha Highway and Kuilima Drive. The Manual on Uniform Traffic Control Devices (MUTCD) provides guidelines to determine the necessity for the installation of traffic signals. The MUTCD recommends that, a "traffic control signal should not be installed unless one or more of the factors" are met. However, the MUTCD goes on to state that the "satisfaction of a traffic signal warrant or engineering analysis and judgment must be used to develop alternative traffic controls to improve operations and safety." Warrants 1 and 2 were analyzed for the intersection of Kamehameha Highway and Kuilima Drive. The traffic signal warrant analysis worksheets are attached in the Appendix.

a. Warrant 1, Eight-Hour Vehicular Volume

Warrant 1 is separated into Conditions A and B. Condition A – Minimum Vehicular Volume is considered when the volume of intersecting traffic over an eight-hour period is the principal reason to consider traffic signalization. The minimum volumes on the major and minor streets are required to meet Condition A. Condition A can be met under special conditions at the 80 percent and 70 percent levels of the minimum volumes on the major and minor streets.

Condition B – Interruption of Continuous Traffic is considered when the traffic volume on the major street is so heavy that traffic on the minor street would suffer excessive delays or conflicts entering or crossing the major street. The minimum volumes on the major and minor streets are required to meet Condition B. Condition B also can be met under special conditions at the 80 percent and 70 percent levels of the minimum volumes on the major and minor streets.

b. Warrant 2, Four-Hour Vehicular Volume

Warrant 2 is considered when the volume of intersecting traffic over a four-hour period is the principal reason to consider traffic signalization. The minimum volumes on the major and minor streets are required to meet Warrant 2 for any 4 hours of an average day.

D. Existing Development

The Turtle Bay Resort is located on the northernmost point of the island of Oahu. The 842-acre Resort property extends from Kawela Bay to Marconi Road. Figure 1 depicts the vicinity map. The existing Turtle Bay Resort includes the Turtle Bay Hotel and Ocean Villas, totaling 500 rooms, two 18-hole golf courses, and the 368-dwelling unit Kuilima Estates. Existing access to the Resort is provided via Kuilima Drive. The existing land uses are depicted on Figure 2.

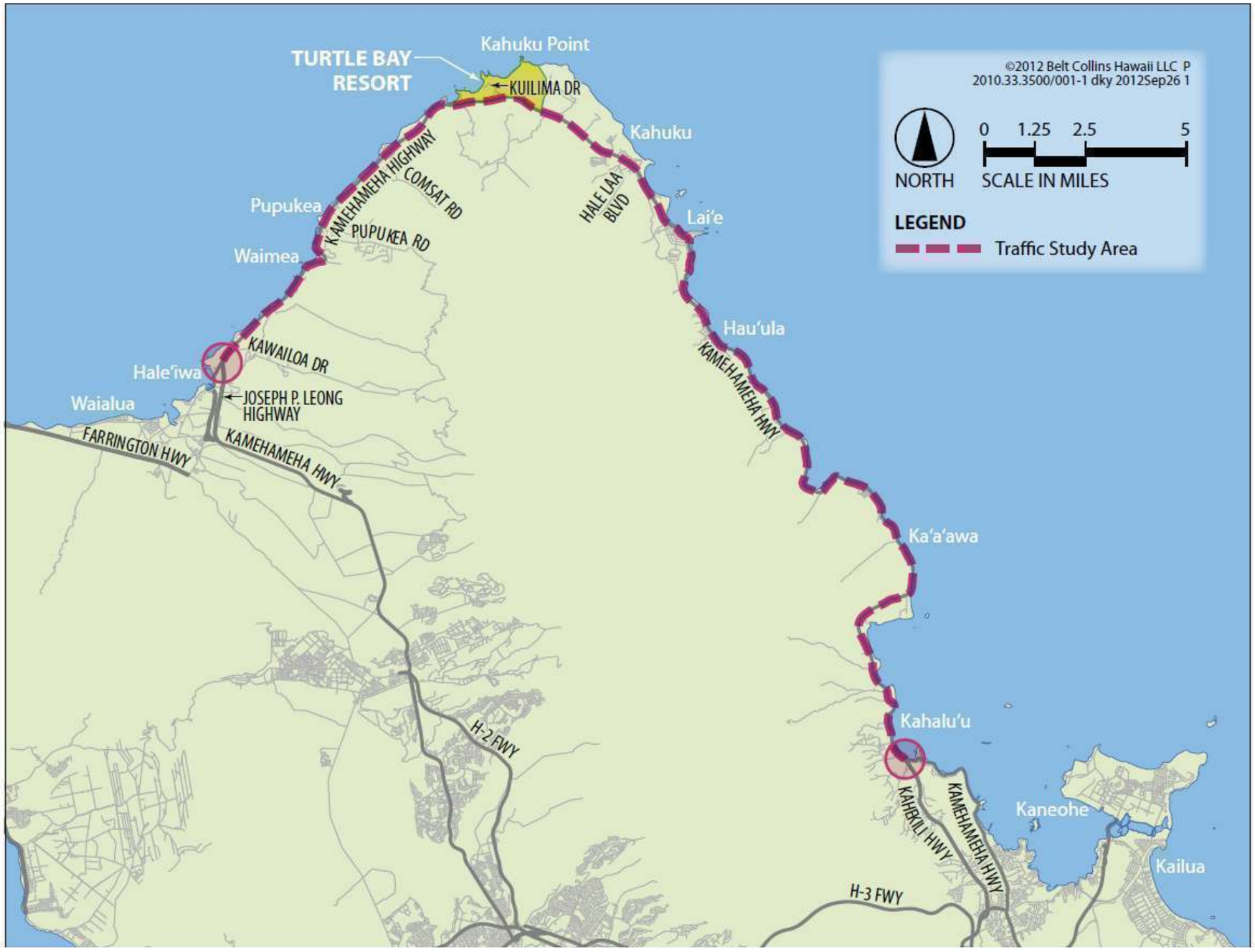


Figure 1. Study Area Map

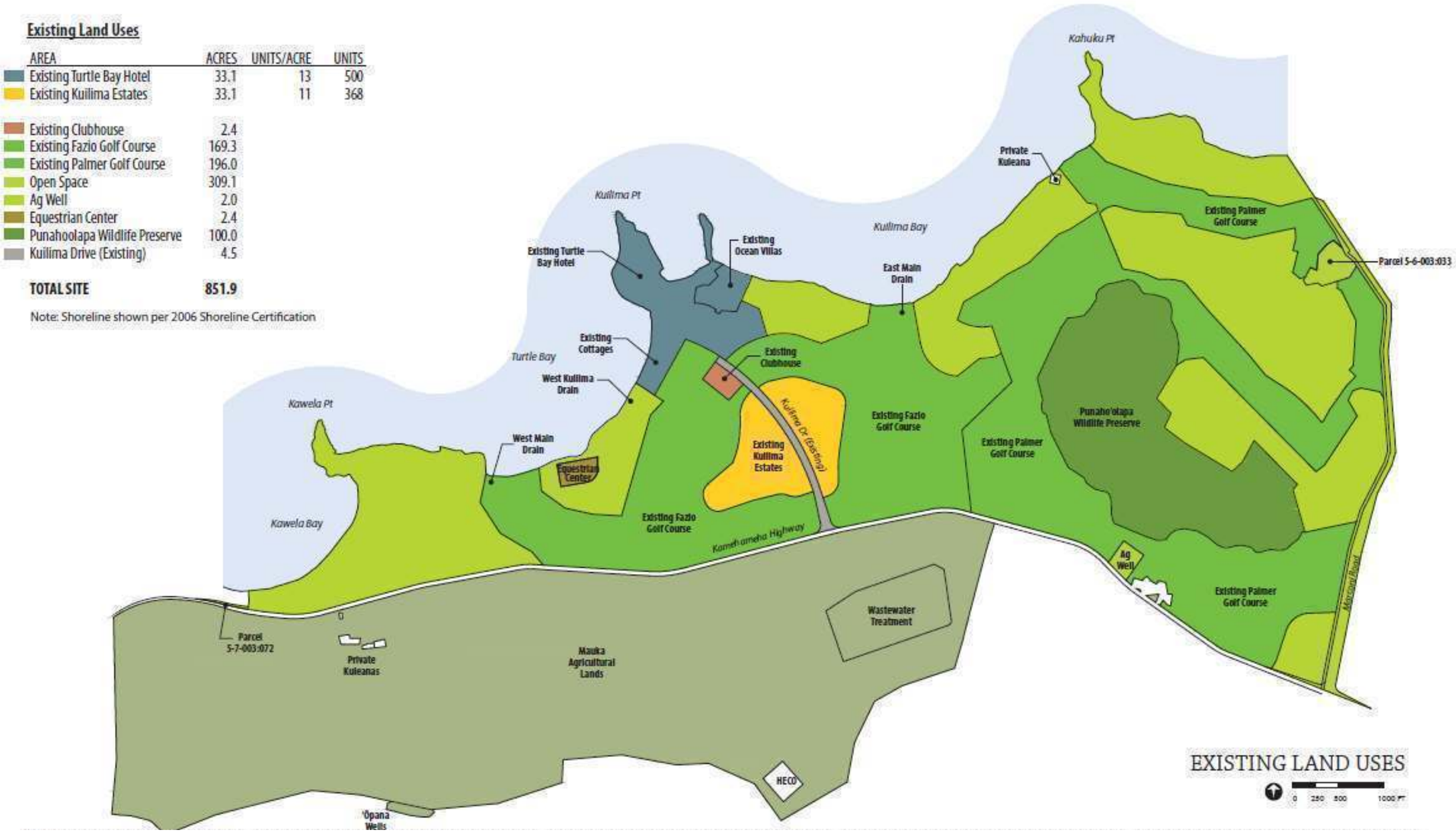


Figure 2. Existing Land Uses

Marconi Road abuts the east edge of Resort golf courses and provides access to properties (owned by others), which are located to the east of the Resort. Two service driveways, which are located on Kamehameha Highway between Kuilima Drive and Marconi Road, provide access to the Palmer Golf Course (G-2). One driveway provides access to the Palmer Golf Course maintenance facility for golf course employees only. The other driveway provides access for large vehicles, which service the golf courses. Both driveways will be maintained for service access under the Proposed Action and the three (3) Alternatives.

II. Proposed Action and Alternative Development Plans

This study analyzes the traffic impacts of the Proposed Action for the Turtle Bay Resort Master Plan at full build out and occupancy by the Year 2025. For the purpose of comparison, the traffic impacts of three (3) Alternatives also are analyzed within the same development time frame. The Proposed Action and the three (3) Alternatives are assumed to begin occupancy in the Year 2015, and reach full build out and occupancy in the Year 2025. Ultimately, market conditions will dictate the actual absorption rates of the various alternative densities. A shorter development time frame will result in a higher proportion of Turtle Bay Resort traffic relative to the background growth in traffic. The annual increase in traffic may be lower while spreading out over a longer time frame. However, the cumulative traffic will be higher as the background growth in traffic continues in the future, which may require more extensive traffic mitigation measures.

A small shopping village (also known as the Gathering Place) is common to the Proposed Action and the three (3) Alternatives. The shopping village will include 40,000 square feet of gross leasable floor area (SFGLFA) for local retails shops and restaurants. The Proposed Action and the three (3) Alternatives also include a farmers market or similar commercial shopping area on Kaihalulu Drive near Kamehameha Highway.

Also common to the Proposed Action and the three (3) Alternatives is a variety of recreational uses, which may include shoreline parks, a bird sanctuary and wildlife preserve, and an equestrian center. Table 2 summarizes the Proposed Action and the three (3) Alternatives analyzed in this traffic impact analysis report (excludes the existing Turtle Bay Hotel, Ocean Villas, and Kuilima Estates).

Table 2. Land Use Summaries – Proposed Action and Alternatives				
Land Use	**Proposed Action**	**Full Build Out**	**Resort Residential**	**Conservation Partner**
Hotel	625 Rooms	2,500 Rooms	0 Rooms	440 Rooms
Resort Residential	590 Units	910 Units	454 Units	252 Units
Community Housing	160 Units	90 Units	46 Units	48 Units
Shopping Village	40,000 SFGLFA	40,000 SFGLFA	40,000 SFGLFA	40,000 SFGLFA
Farmers Market	7.5 Acres	3.4 Acres	3.4 Acres	6.6 Acres
Recreational Uses	182 Acres	160 Acres	171 Acres	166 Acres

A. Proposed Access

Pursuant to the Proposed Action, access to the Resort is proposed at two existing intersections and one new intersection on Kamehameha Highway. The existing intersection of Kamehameha Highway and Kuilima Drive will continue to provide access to Turtle Bay Hotel, Ocean Villas, and Kuilima Estates. The Kuilima Estates are gated at the four entrances on Kuilima Drive. The Turtle Bay Hotel is currently open to the public. The existing intersection of Marconi Road and Kamehameha Highway will provide access to the east side of the Resort, as well as to the properties east of the Resort.

Pursuant to the Proposed Action, access to the west side of the Resort is proposed via a new roadway (formerly known as Alpha Road and West Kuilima Drive), hereinafter referred to as Kaihalulu Drive. Kaihalulu Drive will intersect Kamehameha Highway at a channelized Tee-intersection. The location of the Kaihalulu Drive intersection at Kamehameha Highway varies between the Proposed Action and the three (3) Alternatives. Kaihalulu Drive will continue east through the Resort, crossing Kuilima Drive. With the exception of the Conservation Partner Alternative, Kaihalulu Drive will continue to the east and intersect Marconi Road. Under the Conservation Partner Alternative, Kaihalulu Drive will terminate at the new Golf Clubhouse. Kaihalulu Drive will be open to the public at its intersection at Kamehameha Highway.

Under the State Land Use Commission Decision and Order, the district boundary reclassification for the Turtle Bay Resort lands is subject to a condition that the Resort fund the design and construction of improvements to Kamehameha Highway. These

improvements were described as intersection improvements at Kuilima Drive, Kaihalulu Drive, and Marconi Road. In the Unilateral Agreement (UA) and Declaration for Conditional Zoning recorded by the Turtle Bay Resort, Condition 7 states that the following traffic improvements are to be made throughout the development of the entire project, at the Resort's cost:

- Channelization of the intersection of Kaihalulu Drive (formerly West Kuilima Drive) and Kamehameha Highway.
- Construction of left-turn storage and deceleration lanes on Kamehameha Highway at Kuilima Drive and Kaihalulu Drive.
- Construction of left-turn storage and deceleration lanes on Kamehameha Highway at Marconi Road (formerly Kahuku Airport Road).
- Signalizing Kamehameha Highway at Marconi Road and Kaihalulu Drive.
- Providing a total of six bus turnouts along the portion of Kamehameha Highway fronting the Resort, to be located near each of the entrances to the Resort on both sides of the highway.

The UA requires approval of the proposed roadway improvements by the City and County of Honolulu Departments of Land Utilization and Transportation Services, and the State Department of Transportation. The City approvals for roadway improvements have since be consolidated under the Department of Planning and Permitting. The entitlement conditions also required the reservation of right-of-way along the Resort highway frontage for the future transportation plan.

Under the Proposed Action and the three (3) Alternatives, Park P-1 lot will be located on Kawela Bay on the west end of the Resort, and will be dedicated to the City and County of Honolulu. Park P-1 lot will have legal access on Kamehameha Highway, about one quarter of a mile west of the Kaihalulu Drive intersection.

The Resort accesses on Kamehameha Highway at Kaihalulu Drive, Kuilima Drive, and Marconi Road are common to the Proposed Action and the three (3) Alternatives, analyzed in this traffic impact analysis report, except in the Conservation Partner Alternative, where the concentration of development around the central core of the existing Turtle Bay Hotel and the limited development on the east side of the Resort will not require the extension of Kaihalulu Drive to Marconi Road. Furthermore, the intersection of Kaihalulu Drive and Kamehameha Highway would be located further east under the Conservative Partner Alternative.

B. Proposed Action

The Proposed Action represents a reduction of over sixty percent (60%) from the previously planned density, which was analyzed in the 1985 EIS through the 2009 Revised TIAR Update. One thousand three hundred and seventy-five (1,375) additional units are planned as compared to the 3,500 units, which is allowed under existing land

use approvals ~~Four (4) new hotels~~ One new hotel totaling 625 rooms, 590 resort residential units, and 160 affordable community housing units are included in the Proposed Action. The Proposed Action concentrates the higher density development at the central core of the Resort near the existing Turtle Bay Hotel. Lower density resort-residential developments will be located to the east and west of the core of the Resort. Figure 3 depicts the Proposed Action development plan.

C. Full Build Out Alternative

The Full Build Out (FBO) Alternative represents maximization of the development permitted under current land use entitlements and approvals. Five new hotels, totaling 2,500 rooms, 910 new resort residential units, and 90 affordable community housing units are included under the FBO Alternative. The additional 3,500 units under the FBO Alternative is comparable to the density analyzed in the 1985 EIS through the 2009 Revised TIAR Update. The FBO Alternative development plan is depicted on Figure 4.

D. Resort Residential Alternative

The Resort Residential (RR) Alternative represents the development of an exclusive resort residential community, which excludes future hotel development in the Turtle Bay Resort. The Resort Residential Alternative represents the lowest density among the Proposed Action and the three (3) Alternatives with 454 new resort residential units and 46 affordable community housing units. Figure 5 depicts the Resort Residential Alternative development plan.

E. Conservation Partner Alternative

The Conservation Partner (CP) Alternative concentrates all future development in the core of the Resort, and maintains open space along the Resort's coastline at Kawela Bay and on the eastern half of the Resort where the existing golf courses are located. The Conservation Partner Alternative includes 440 new hotel rooms, 252 new resort residential units, and 48 affordable community housing units. The Conservation Partner Alternative development plan is depicted on Figure 6.

III. Existing Conditions

A. Roadways

Kamehameha Highway is the primary arterial highway in the North Shore area and Windward Oahu. Kamehameha Highway is a two-way, two-lane highway with posted speeds, which range from 25 miles per hour in the build-up towns along the North Shore and Windward coast to 45 mph along isolated segments of the Highway. In the vicinity of Kuilima Drive, the Kamehameha Highway speed limit is posted at 35 mph. According to DOT traffic data collected in 2011, Kamehameha Highway carried about 9,700 vehicles per day (vpd), total for both directions, west of Turtle Bay Resort. Further to the west, Kamehameha Highway carried about 16,000 vpd, north of the Joseph P. Leong Highway junction in Haleiwa. To the east, Kamehameha Highway carried approximately 19,000 vpd, north of the Kahekili Highway junction in Kahaluu.

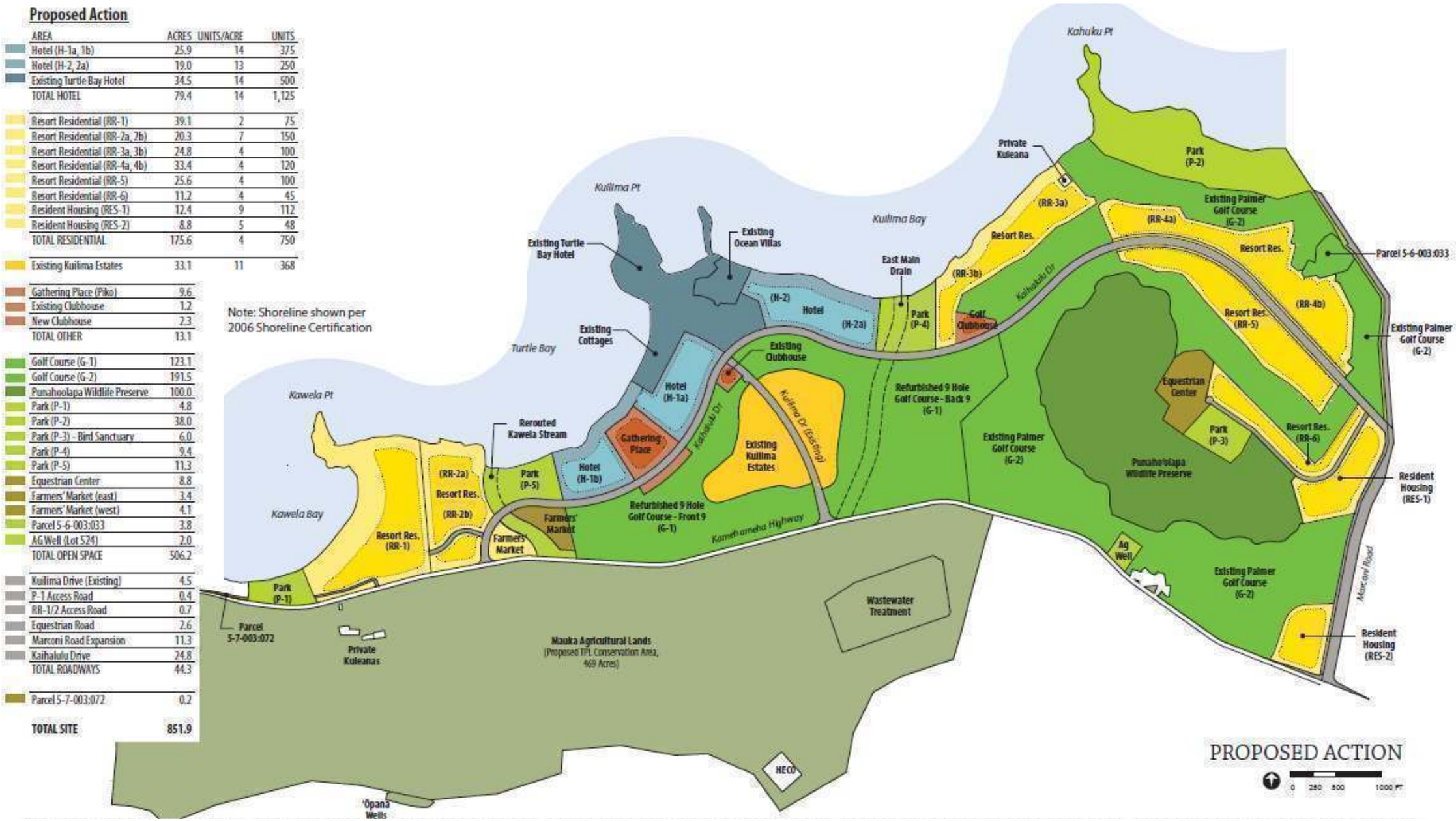


Figure 3. Turtle Bay Resort Master Plan – Proposed Action

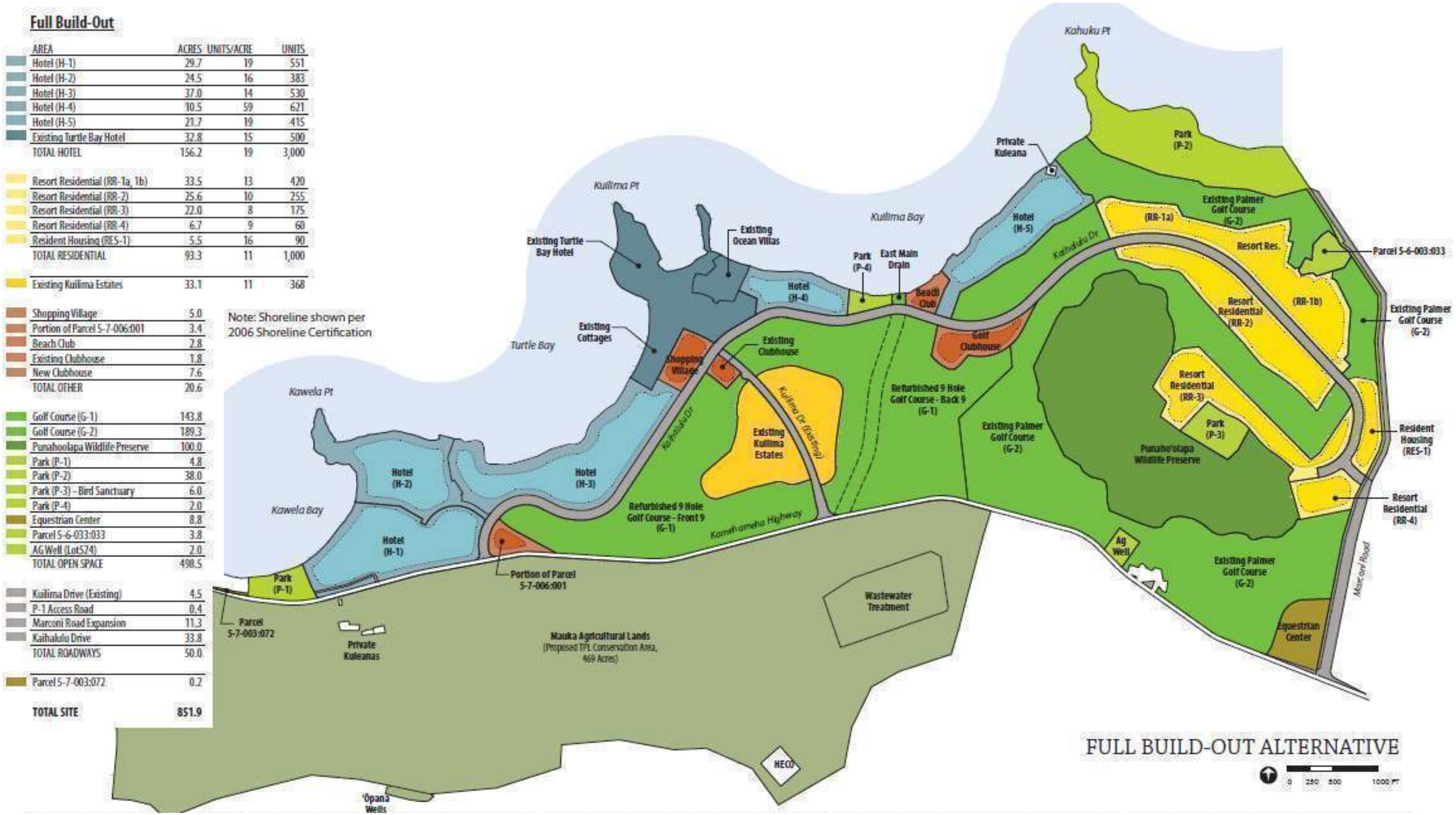


Figure 4. Turtle Bay Resort Master Plan – Full Build Out Alternative

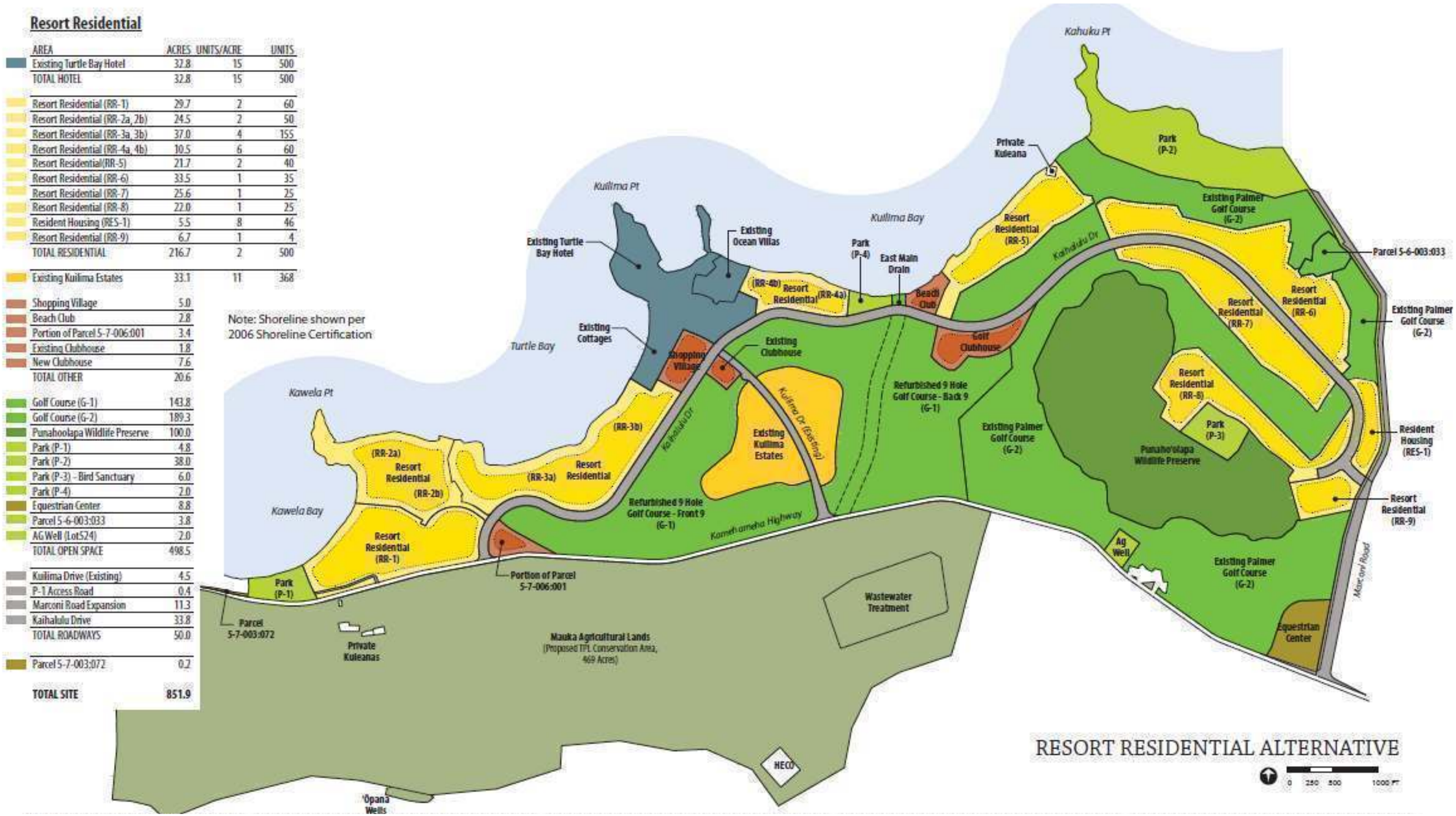


Figure 5. Turtle Bay Resort Master Plan – Resort Residential Alternative

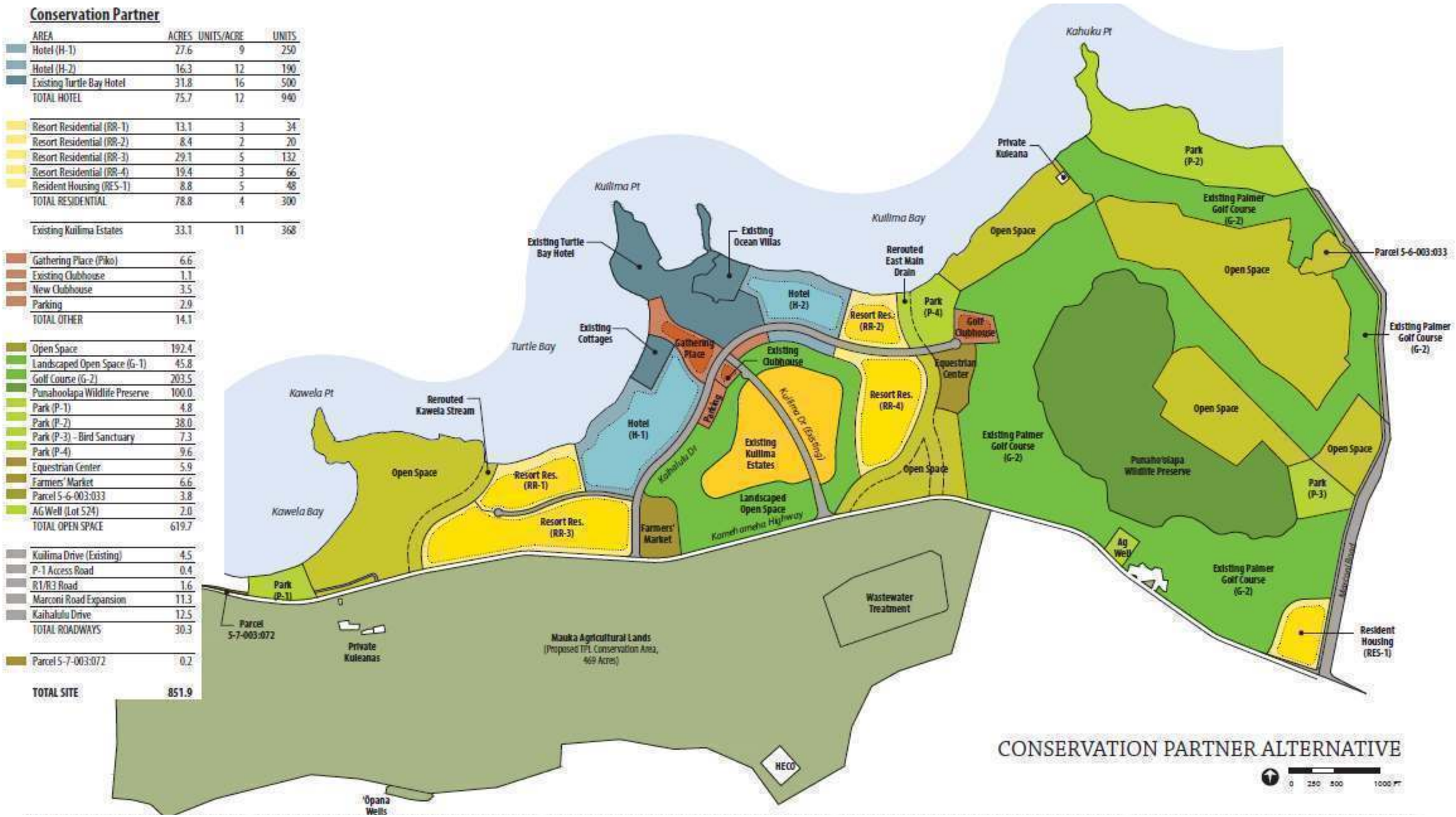


Figure 6. Turtle Bay Resort Master Plan – Conservation Partner Alternative

Kuilima Drive is a two- to four-lane, two-way roadway. Kuilima Drive intersects Kamehameha Highway at a stop-controlled Tee-intersection. Kamehameha Highway currently does not have provisions for exclusive turning lanes at Kuilima Drive. Kuilima Drive provides access to the existing Turtle Bay Resort Hotel and Golf Club and Kuilima Estates. Kuilima Drive carried an average of about 4,200 vpd, total for both directions during the 2011 field investigation for this study.

Marconi Road is a two-lane, two-way roadway, which intersects Kamehameha Highway at a stop-controlled Tee-intersection. Kamehameha Highway currently does not provide exclusive turning lanes at Marconi Road. Marconi Road is a low volume roadway, which provides access to existing residential dwelling units and the coastline.

Joseph P. Leong Highway is a two-way, two-lane high quality highway, which is a continuation of Kamehameha Highway that bypasses Haleiwa Town (also known as the Haleiwa Bypass Highway). At its north junction, the east leg of Kamehameha Highway intersects Kamehameha Highway/Joseph P. Leong Highway at a signalized Tee-intersection. The southbound approach of Kamehameha Highway includes an exclusive right-turn lane, and the northbound approach of Joseph P. Leong Highway includes an exclusive left-turn lane.

Kahekili Highway is a two-way, two-lane high quality highway, which is a continuation of Kamehameha Highway that bypasses Kaneohe Town. The east leg of Kamehameha Highway is stop-controlled at its Tee-intersection with Kamehameha Highway/Kahekili Highway. Southbound Kamehameha Highway does not have provisions for an exclusive left-turn lane to the eastbound Kamehameha Highway. Northbound Kahekili Highway has an exclusive right-turn lane to the eastbound Kamehameha Highway.

B. Existing Peak Hour Traffic Volumes and Operating Conditions

1. Field Investigation and Data Collection

Traffic count surveys were conducted at the Kamehameha Highway intersections at Kuilima Drive and at Marconi Road on November 3, 2011 (Thursday) and on November 5, 2011 (Saturday). The field investigation was conducted during the high surf season on the North Shore, but prior to the Vans Trip Crown of Surfing. Turning movement and vehicle classification traffic counts were taken at the intersection of Kamehameha Highway and Kuilima Drive from 6:00 AM to 6:00 PM during the weekday, and from 9:00 AM to 6:00 PM on Saturday. Turning movement traffic counts also were taken at the intersection of Kamehameha Highway and Marconi Road during the peak periods of traffic.

A week-long traffic count survey was conducted on Kuilima Drive at Kamehameha Highway and at the Turtle Bay Hotel entrance from Sunday, October 30, 2011 to Sunday, November 6, 2011. The purpose of the survey was to develop trip generation characteristics for the resort hotel and resort residential units at Turtle Bay Resort. The traffic count survey was coordinated with a travel interview survey, which was conducted by SMS Research & Marketing Services, Inc. (SMS) at Turtle

Bay Hotel and Kuilima Estates from November 1, 2011 through November 6, 2011. The purpose of the interview survey was to determine the origins and destinations of all traffic entering and exiting the Resort. The results of SMS survey provided the basis for the geographic trip distribution of the Turtle Bay Resort trips.

The limits of the study area were recommended by DOT, during pre-consultation meetings. The study area extends over 35 miles along the North Shore and Windward Oahu between the intersection of Kamehameha Highway and Joseph P. Leong Highway in Haleiwa, and the intersection of Kamehameha Highway and Kahekili Highway in Kahaluu. Peak period traffic count surveys were conducted at these intersections on October 29, 2011 (Saturday) and November 1, 2011 (Monday). The traffic survey data are presented in the Appendix.

While surfing on the North Shore is a major attraction on Oahu, the beach locations are spread out over seven (7) miles and affect traffic only during high surf conditions and surfing contests. In past several years Laniakea (Turtle Beach) has also become a popular attraction due to the daily presence of sea turtles that come ashore. The other major traffic generator in the study area is concentrated in La`ie, which includes the Polynesian Cultural Center (PCC) and Brigham Young University Hawaii (BYU-H). "Envision La`ie" is the long-range plan for PCC, BYU-H, and the surrounding lands, which are owned and managed by Hawaii Reserves, Inc. in affiliation The Church of Jesus Christ of Latter-Day Saints. The planning of Envision La`ie is still being developed at this writing, while Hawaii Reserves, Inc. seeks entitlement and zoning approvals. Without a detailed development proposal, a transportation plan cannot be developed and included in this cumulative traffic analysis. Therefore, Envision La`ie was excluded from this traffic impact analysis.

2. Existing AM Peak Hour of Weekday Traffic

Turtle Bay Resort is located at the northernmost point of the island of Oahu, while the Primary Urban Center of Oahu is located along the south shore of the island. The traditional AM peak period of commuter traffic, which generally occurs between 6:00 AM and 9:00 AM in urban areas, was virtually non-existent in the vicinity of Turtle Bay Resort. Kamehameha Highway peak period traffic was typical of a scenic/recreational route.

The AM peak hour of weekday traffic on Kamehameha Highway, in the vicinity of Turtle Bay Resort, occurred between 11:00 AM and 12:00 Noon. Kamehameha Highway carried about 500 vehicles per hour (vph), total for both directions, which continued to increase in the afternoon. Kamehameha Highway operated at LOS "E", with a v/c ratio of 0.18, west of Kuilima Drive.

The left-turn and right turn movements from Kuilima Drive at Kamehameha operated at LOS "C" and LOS "B", respectively during the AM peak hour of weekday traffic. Marconi Road operated at LOS "B" at Kamehameha Highway.

The typical AM peak hour of commuter traffic also was not evident at the western end of the study area in Haleiwa. The AM peak hour of weekday traffic occurred between 10:45 AM and 11:45 AM at the north junction of the intersection of Kamehameha Highway and Joseph P. Leong Highway. North of Joseph P Leong Highway, Kamehameha Highway carried about 1,100 vph, total for both directions. Kamehameha Highway operated at LOS "E" with a v/c ratio of 0.35 north of Haleiwa. The intersection of Kamehameha Highway and Joseph P. Leong Highway operated at an overall LOS "B" during the AM peak hour of weekday traffic. The individual traffic movements at the intersection operated at satisfactory Levels of Service, i.e. LOS "C" or better.

The AM peak hour of weekday traffic at the eastern end of the study area in Kahaluu occurred between 6:45 AM and 7:45 AM. North of Kahekili Highway, Kamehameha Highway carried about 1,200 vph, total for both directions, and operated at LOS "E" with a v/c ratio of 0.41. The predominant traffic movement was on southbound Kamehameha Highway with about 800 vph, which split between continuing onto Kahekili Highway and turning left into Kamehameha Highway. The left-turn movement from eastbound Kamehameha Highway operated at LOS "F" onto Kahekili Highway. However, the left-turn demand was relatively low at less than 40 vph, and the observed delays were much lower than calculated delays when courteous motorists on southbound Kamehameha Highway permitted the left-turn movement from westbound Kamehameha Highway. The other traffic movements at the intersection operated at satisfactory Levels of Service. The existing AM peak hour traffic volumes are depicted on Figure 7.

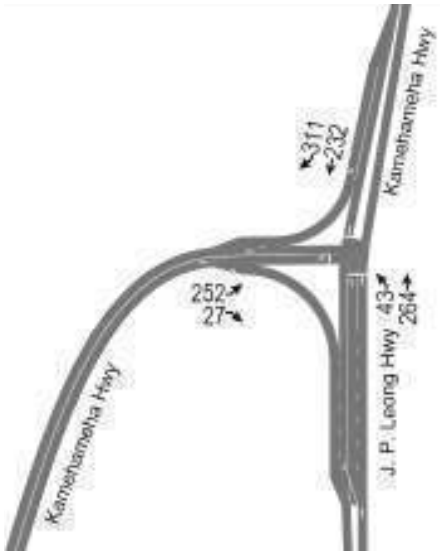
3. Existing PM Peak Hour Traffic

The typical PM peak hour of commuter traffic, which occurs between 3:00 PM and 6:00 PM in urban areas, also was not evident in the vicinity of Turtle Bay Resort. The PM peak hour of weekday traffic on Kamehameha Highway occurred between 2:00 PM and 3:00 PM. Kamehameha Highway carried about 700 vph, total for both directions in the vicinity of Turtle Bay Resort. West of Kuilima Drive, Kamehameha Highway operated at LOS "E", with a v/c ratio of 0.26.

The left-turn and right turn movements from Kuilima Drive at Kamehameha Highway operated at LOS "C" and LOS "B", respectively during the PM peak hour of weekday traffic. Marconi Road operated at LOS "B" at Kamehameha Highway.

The PM peak hour of weekday traffic in Haleiwa occurred between 2:45 PM and 3:45 PM. Kamehameha Highway carried over 1,400 vph, total for both directions. Kamehameha Highway operated at LOS "E" with a v/c ratio of 0.48 north of Haleiwa. The intersection of Kamehameha Highway and Joseph P. Leong Highway operated at an overall LOS "B" during the PM peak hour of weekday traffic. The individual traffic movements at the intersection operated at satisfactory Levels of Service.

Project Vicinity



Haleiwa

Kahaluu

<u>Legend</u>

Lane Controls

137→ **Traffic Movement Volume (vph)**

Figure 7. Existing AM Peak Hour Traffic

The PM peak hour of weekday traffic in Kahaluu occurred between 3:30 PM and 4:30 PM. Kamehameha Highway carried about 1,500 vph, total for both directions. North of the Kahekili Highway intersection, Kamehameha Highway operated at LOS "E" with a v/c ratio of 0.48. The traffic movements at the intersection of Kamehameha Highway and Kahekili Highway operated at satisfactory Levels of Service. Figure 8 depicts the existing PM peak hour traffic volumes.

4. Existing Peak Hour of Weekend Traffic

The weekend peak hour of traffic is represented by a single peak hour on Saturday or Sunday. The existing weekend traffic data in the study area indicated that Sunday traffic was lower than Saturday traffic. Lower Sunday traffic can be attributed, in part, to the fact that PCC does not operate on Sundays. In addition, the Saturday peak hour trip generation rates for hotels, which are developed by the Institute of Transportation Engineers (ITE), are higher than the Sunday peak hour trip rates. During the pre-consultation meetings with DOT, it was mutually agreed that the Saturday peak hour traffic would represent the weekend peak hour traffic in the study area.

The peak hour of weekend traffic in Kahuku occurred between 2:00 PM and 3:00 PM. Kamehameha Highway carried almost 900 vph, total for both directions. Kamehameha Highway operated at LOS "E", with a v/c ratio of 0.29. The left-turn and right turn movements from Kuilima Drive at Kamehameha Highway operated at LOS "D" and LOS "B", respectively during the peak hour of weekend traffic. Marconi Road operated at LOS "B" at Kamehameha Highway.

In Haleiwa, the peak hour of weekend traffic occurred between 11:45 AM and 12:45 PM. Kamehameha Highway carried almost 1,600 vph, total for both directions. Kamehameha Highway operated at LOS "E" with a v/c ratio of 0.54 north of Haleiwa. The queuing on northbound Kamehameha Highway was a result of traffic congestion at Laniakea Beach, where motorists are turning on and off the Highway and stopping for pedestrians cross the Highway. The intersection of Kamehameha Highway and Joseph P. Leong Highway operated at an overall LOS "B" during the peak hour of weekend traffic. The left-turn movement on northbound Joseph P. Leong Highway operated at LOS "D". The other traffic movements at the intersection operated at satisfactory Levels of Service.

The peak hour of weekend traffic in Kahaluu occurred between 2:15 PM and 3:15 PM. Kamehameha Highway carried about 1,500 vph, total for both directions. North of its intersection with Kahekili Highway, Kamehameha Highway operated at LOS "E" with a v/c ratio of 0.50. The traffic movements at the intersection of Kamehameha Highway and Kahekili Highway operated at satisfactory Levels of Service. Figure 9 depicts the existing weekend peak hour traffic volumes. Table 3 summarizes the intersection analysis for the existing peak hours of traffic. Table 4 summarizes the Kamehameha Highway two-lane traffic operations for the existing peak hours of traffic.

Project Vicinity

Haleiwa

Kahaluu

<u>Legend</u>

Lane Controls

137→ **Traffic Movement Volume (vph)**

Figure 8. Existing PM Peak Hour Traffic

Project Vicinity

Haleiwa

Kahaluu

<u>Legend</u>

Lane Controls

137→ **Traffic Movement Volume (vph)**

Figure 9. Existing Weekend Peak Hour Traffic

Table 4. Intersection Traffic Analysis Summary - Existing Peak Hour Conditions

Scenario	Kamehameha Hwy Intersection	MOE	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	Intersection
Existing AM Peak Hour of Weekday Traffic	Kuilima Drive	LOS	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	C	N/A	B	A
		Delay	8.1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	15.8	N/A	10.4	3.8
		v/c	0.07	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.18	N/A	0.11	N/A
	Marconi Rd	LOS	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	B			A
		Delay	7.8	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	11.5			0.2
		v/c	0.00	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.02			N/A
	Joseph P. Leong Hwy	LOS	C	N/A	A	N/A	N/A	N/A	C	A	N/A	N/A	B	A	B
		Delay	24.4	N/A	0.2	N/A	N/A	N/A	26.1	8.3	N/A	N/A	13.9	3.7	12.7
		v/c	0.65	N/A	0.05	N/A	N/A	N/A	0.31	0.31	N/A	N/A	0.30	0.39	N/A
	Kahekili Hwy	LOS	N/A	N/A	N/A	F	N/A	N/A	N/A	N/A	N/A	B	N/A	N/A	F
		Delay	N/A	N/A	N/A	>300	N/A	N/A	N/A	N/A	N/A	12.2	N/A	N/A	78.0
		v/c	N/A	N/A	N/A	>1.2	N/A	N/A	N/A	N/A	N/A	0.55	N/A	N/A	N/A
Existing PM Peak Hour of Weekday Traffic	Kuilima Drive	LOS	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	C	N/A	B	A
		Delay	8.4	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	22.6	N/A	11.4	3.6
		v/c	0.09	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.26	N/A	0.15	N/A
	Marconi Rd	LOS	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	B			A
		Delay	8.1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	13.3			0.3
		v/c	0.01	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.03			N/A
	Joseph P. Leong Hwy	LOS	C	N/A	A	N/A	N/A	N/A	C	A	N/A	N/A	B	A	B
		Delay	25.6	N/A	0.2	N/A	N/A	N/A	32.2	9.3	N/A	N/A	15.8	3.7	13.6
		v/c	0.69	N/A	0.05	N/A	N/A	N/A	0.39	0.38	N/A	N/A	0.45	0.45	N/A
	Kahekili Hwy	LOS	N/A	N/A	N/A	B	N/A	N/A	N/A	N/A	N/A	A	N/A	N/A	A
		Delay	N/A	N/A	N/A	13.4	N/A	N/A	N/A	N/A	N/A	9.6	N/A	N/A	2.8
		v/c	N/A	N/A	N/A	0.41	N/A	N/A	N/A	N/A	N/A	0.09	N/A	N/A	N/A
Existing Weekend Peak Hour of Traffic	Kuilima Drive	LOS	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	D	N/A	B	A
		Delay	8.9	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	32.6	N/A	12.1	4.3
		v/c	0.14	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.37	N/A	0.17	N/A
	Marconi Rd	LOS	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	B			A
		Delay	8.2	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	12.1			0.3
		v/c	0.00	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.03			N/A
	Joseph P. Leong Hwy	LOS	C	N/A	A	N/A	N/A	N/A	D	B	N/A	N/A	B	A	B
		Delay	25.1	N/A	0.4	N/A	N/A	N/A	42.6	12.3	N/A	N/A	17.7	4.2	15.1
		v/c	0.74	N/A	0.09	N/A	N/A	N/A	0.51	0.50	N/A	N/A	0.51	0.52	N/A
	Kahekili Hwy	LOS	N/A	N/A	N/A	C	N/A	N/A	N/A	N/A	N/A	A	N/A	N/A	A
		Delay	N/A	N/A	N/A	16.6	N/A	N/A	N/A	N/A	N/A	9.7	N/A	N/A	2.9
		v/c	N/A	N/A	N/A	0.45	N/A	N/A	N/A	N/A	N/A	0.10	N/A	N/A	N/A

Table 4. Existing Peak Hour Two-Lane Operations on Kamehameha Highway			
Peak Hour	**Location**	**LOS**	**v/c**
Weekday AM	Haleiwa	E	0.35
	Kahuku	E	0.18
	Kahaluu	E	0.41
Weekday PM	Haleiwa	E	0.48
	Kahuku	E	0.26
	Kahaluu	E	0.48
Weekend	Haleiwa	E	0.54
	Kahuku	E	0.29
	Kahaluu	E	0.50

5. Traffic Signal Warrant Analysis

The existing weekday traffic conditions at the intersection of Kamehameha Highway and Kuilima Drive meet the 70 percent levels for Warrant 1, Conditions A and B, between the hours of 10:00 AM and 4:00 PM. According to the MUTCD, "if the intersection lies within the built-up area of an isolated community having a population of less that 10,000 or speeds on the major highway exceeds 40 mph, the traffic volumes in the 70 percent columns in Table 4C-1 of the MUTCD may be used." The population criterion applies to the Kahuku area. Therefore, Warrant 1, Conditions A and B of the MUTCD were met at the intersection of Kamehameha Highway and Kuilima Drive under existing conditions. The traffic signal warrant worksheet is attached in the Appendix.

IV. Future Traffic Conditions Without Proposed Action

A. Existing Turtle Bay Resort

During the trip generation survey, the reported occupancies for Turtle Bay Hotel ranged from 72 percent to 96 percent. The estimated occupancies for Kuilima Estates ranged from 45 percent to 63 percent. The existing Turtle Bay Hotel traffic, under future traffic conditions without the Proposed Action, was analyzed at occupancy rates of 90 percent and 95 percent during the weekday and weekend peak hours of traffic without the Proposed Action, respectively. Similarly, the existing Kuilima Estates were analyzed at 60 percent occupancies for both the weekday and weekend peak hours of traffic. The occupancy levels were based upon the assumptions, which were recommended by DOT during pre-consultation meetings.

B. Future Roadway Improvements

The Oahu Regional Transportation Plan 2035 (ORTP) mid-range projects through the Year 2020 include the construction of "safety improvements along Kamehameha Highway, from Haleiwa to Kahaluu. Safety improvements include turn lanes, guardrails, signage, crosswalks, etc., to improve safety." The ORTP goes on to state that the "Widening of Kamehameha Highway will only be in areas where needed for storage/turn lanes and safety improvements." Notwithstanding, DOT continues to request reservation or dedication of rights-of-way for future widening of Kamehameha Highway. However, DOT has deferred further planning for the widening in response to community opposition to a four-lane highway.

C. Kahuku Mauka Agricultural Lots

The Kahuku Mauka Agricultural Lots is located on south side of Kamehameha Highway to the east of Turtle Bay Resort. The agricultural subdivision is not part of the Proposed Action because the property is not owned by Turtle Bay Resort. The future access from Kamehameha Highway to the agricultural project will be constructed (by others) opposite Marconi Road, creating a four-legged intersection. Therefore, it is included as part of the cumulative traffic analysis both with and without the Proposed Action and with the three (3) Alternatives.

The traffic assessment of a proposed agricultural subdivision (TMK: 5-6-003: 010, 026, & 032) was prepared by Julian Ng, Incorporated, dated June 6, 2008. The Ng traffic study analyzed the traffic impacts of a 36-lot agricultural subdivision. The Ng study included the findings of another Ng study, Traffic Analysis Report, Kahuku Mauka Agricultural Lots, Phases I & II, dated August 2007.

The current status of the Kahuku Mauka Agricultural Lots was obtained from Bow Engineering & Development, Inc. The 36-lot subdivision plan has been consolidated into a 3-large lot subdivision. The construction of the Kahuku Agricultural Access Road, opposite Marconi Road, is being deferred until the development of the 36-lot subdivision plan resumes. For purpose of this analysis, it is assumed that the Kahuku Mauka Agricultural Lots would be fully developed by the Year 2025. The trip generation and traffic assignments from the Ng studies were incorporated into the future traffic analysis of the study area.

D. Regional Traffic Forecasts

Year 2025 traffic conditions without the Proposed Action are developed to establish the baseline conditions from which to evaluate the traffic impacts of the Proposed Action and the three (3) Alternatives. The Institute of Transportation Engineers (ITE) indicates that an area-wide transportation plan is "often used with large projects that will be developed over a long period of time" (Transportation Impact Analysis for Site Development). ITE goes on to suggest that regional travel forecasts can be more accurate than the straight-line growth projections, based upon historical trends, especially for large developments that occur over a long period of time.

The Oahu Regional Transportation Plan 2035 (ORTP), was prepared for the Oahu Metropolitan Planning Organization (OMPO) in April 2011. The Year 2035 weekday traffic forecasts on the North Shore and Windward Oahu were obtained from OMPO, through the assistance of DOT.

The Year 2025 traffic forecasts on Kamehameha Highway were derived by interpolating between the Year 2035 ORTP model forecasts and the Base Year 2011 DOT data for weekday traffic, assuming a straight-line growth pattern. (Weekend traffic was not analyzed in the ORTP). Three locations on Kamehameha Highway were selected for the regional traffic assessment: northeast of Joseph P. Leong Highway in Haleiwa, west of Kuilima Drive in Kahuku, and northwest of Kahekili Highway in Kahaluu. Table 5 compares the with DOT 2011 traffic data, the ORTP 2035 traffic forecasts, and the interpolated 2025 traffic forecasts used in this study.

Table 5. Existing and Future Weekday Traffic

Location	2011 Traffic (DOT)	2025 Traffic (Interpolated)	2035 Traffic (ORTP)	Average Annual Growth
	Totals	Totals	Totals	Totals
Haleiwa	16,101	16.759	17,229	0.29 %
Kahuku	9,666	11,329	12,516	1.23 %
Kahaluu	19,130	23,012	25,784	1.45 %

Over a 24-year period between the Years 2011 and 2035, the ORTP projected relatively low growth (7 percent) in Haleiwa, and more moderate growth (30-35 percent) in the Kahuku and Kahaluu areas. It should be noted that OMPO reported that the ORTP forecasts included a total of 1,184 resort units at Turtle Bay Resort, i.e., about 300 more resort units than the existing Turtle Bay Hotel, Ocean Villas, and Kuilima Estates. Therefore, use of the ORTP forecast to establish future traffic conditions with and without the Proposed Action can considered to be conservative, i.e., it overestimates the future traffic on the North Shore and Windward Oahu.

The average annual growth rates were applied uniformly to peak hour traffic in the respective areas to establish the Year 2025 peak hour traffic conditions without the Proposed Action. In the vicinity of Turtle Bay Resort, the average annual growth rate was applied only to through and pass-by traffic and not to Turtle Bay Resort traffic.

E. Year 2025 Peak Hour Traffic Analysis Without the Proposed Action

1. Year 2025 AM Peak Hour Traffic Without the Proposed Action

During the Year 2025 AM peak hour of traffic without the Proposed Action, the Kuilima Drive and Marconi Road intersections on Kamehameha Highway are expected to operate at satisfactory Levels of Service. The two-lane section of

Kamehameha Highway is expected to operate at LOS "E", with a v/c ratio of 0.22, in the project vicinity.

The intersection of Kamehameha Highway and Joseph P. Leong Highway in Haleiwa also is expected to operate at satisfactory Levels of Service, during the Year 2025 AM peak hour of traffic without the Proposed Action. North of Haleiwa, Kamehameha Highway is expected to operate at LOS "E", with a v/c ratio of 0.38, during the Year 2025 AM peak hour of traffic without the Proposed Action.

In Kahaluu, the westbound approach of Kamehameha Highway at Kamehameha Highway/Kahekili Highway is expected to operate at LOS "F", during the Year 2025 AM peak hour of traffic without the Proposed Action. Kamehameha Highway is expected to operate at LOS "E", with a v/c ratio of 0.51, in the Kahaluu area. Figure 10 depicts the Year 2025 AM peak hour traffic without the Proposed Action.

2. Year 2025 PM Peak Hour Traffic Without the Proposed Action

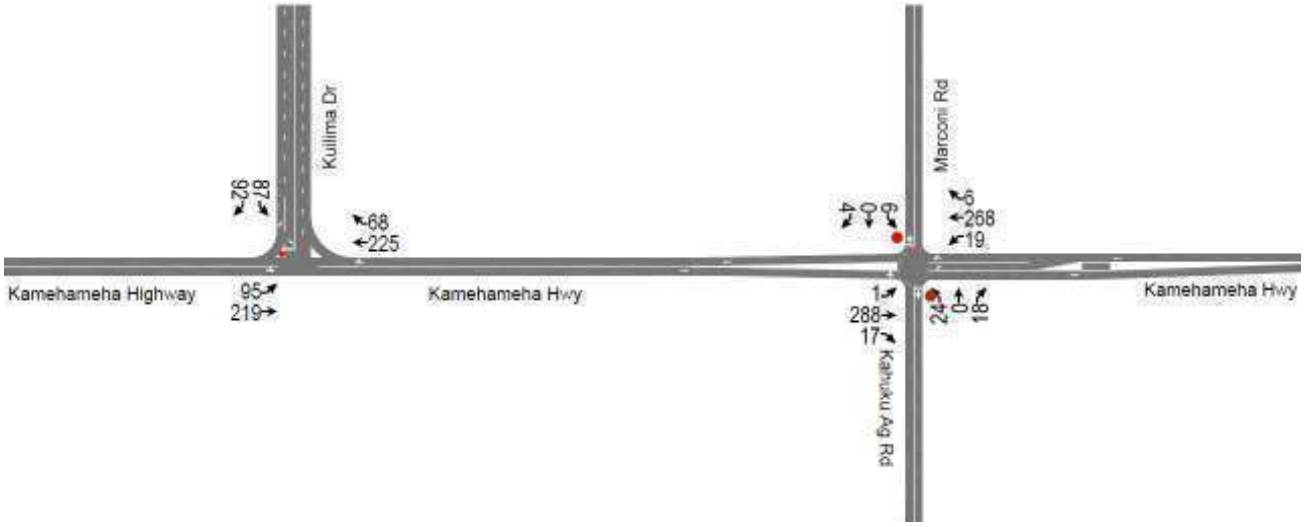
Kuilima Drive is expected to operate at LOS "E" at Kamehameha Highway, during the Year 2025 PM peak hour of traffic without the Proposed Action. The intersection of Kamehameha Highway and Marconi Road is expected to operate at satisfactory Levels of Service. West of Kuilima Drive, Kamehameha Highway is expected to operate at LOS "E", with a v/c ratio of 0.33, during the Year 2025 PM peak hour of traffic without the Proposed Action.

In Haleiwa, the intersection of Kamehameha Highway and Joseph P. Leong Highway also is expected to operate at satisfactory Levels of Service. Kamehameha Highway is expected to operate at LOS "E", with a v/c ratio of 0.52, north of Haleiwa.

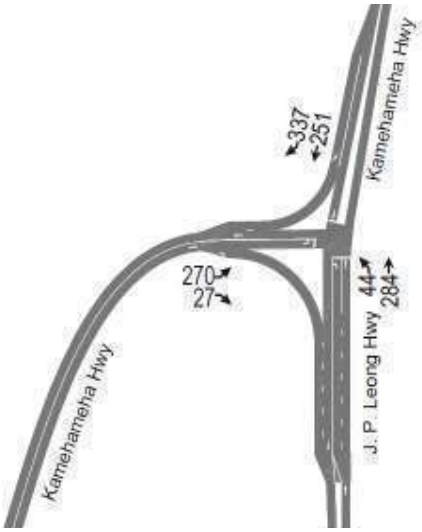
The westbound approach of Kamehameha Highway is expected to operate at LOS "F" at Kamehameha Highway/Kahekili Highway in Kahaluu. North of Kahekili Highway, Kamehameha Highway is expected to operate at LOS "E", with a v/c ratio of 0.60. The Year 2025 PM peak hour traffic without the Proposed Action is depicted on Figure 11.

3. Year 2025 Weekend Peak Hour Traffic Without the Proposed Action

During the Year 2025 weekend peak hour of traffic without the Proposed Action, the left-turn movement from Kuilima Drive onto Kamehameha Highway is expected to operate at LOS "F". Marconi Road and Kahuku Agricultural Road are expected to operate at satisfactory Levels of Service at Kamehameha Highway. Kamehameha Highway is expected to operate at LOS "E", with a v/c ratio of 0.35, in the project vicinity, during the Year 2025 weekend peak hour of traffic without the Proposed Action.



Project Vicinity



Haleiwa

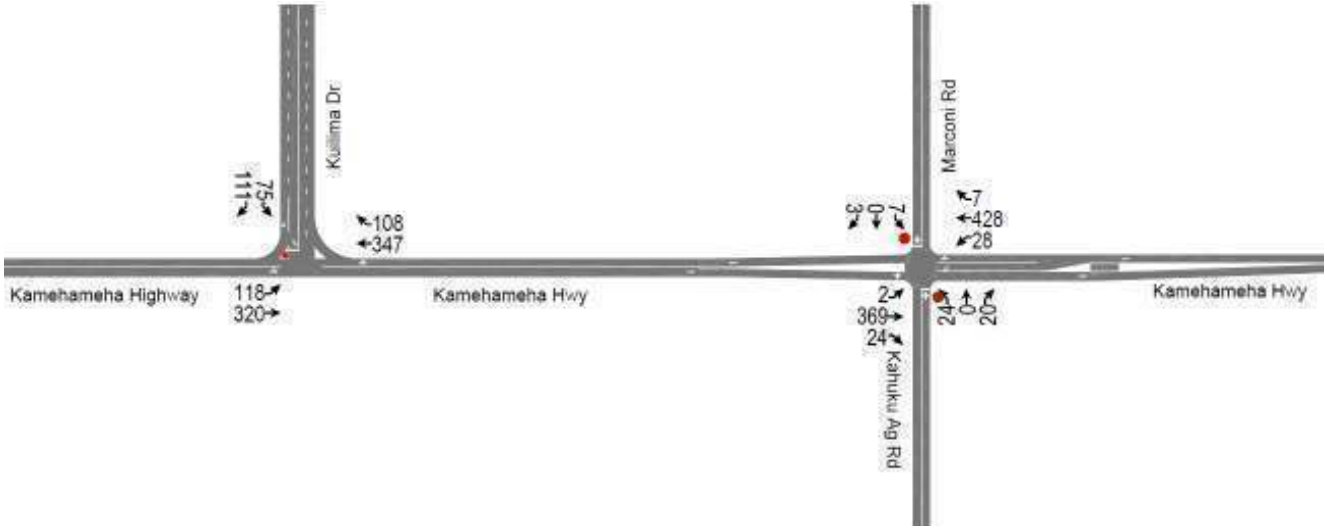
Kahaluu

Legend

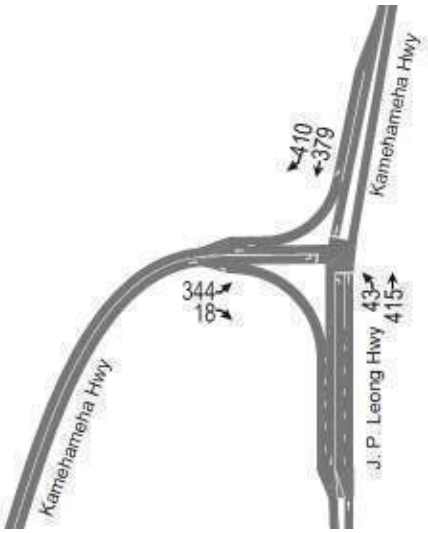
Lane Controls

137→ **Traffic Movement Volume (vph)**

Figure 10. Year 2025 AM Peak Hour Traffic Without the Proposed Action



Project Vicinity



Haleiwa

Kahaluu

<u>Legend</u>

Lane Controls

137→ **Traffic Movement Volume (vph)**

Figure 11. Year 2025 PM Peak Hour Traffic Without the Proposed Action

The left-turn movement from northbound Joseph P. Leong Highway to westbound Kamehameha Highway in Haleiwa is expected to operate at LOS "D". The other traffic movements at the intersection of Kamehameha Highway and Joseph P. Leong Highway are expected to operate at satisfactory Levels of Service. North of Haleiwa, Kamehameha Highway is expected to operate at LOS "E", with a v/c ratio of 0.57, during the Year 2025 weekend peak hour of traffic without the Proposed Action.

The westbound approach of Kamehameha Highway is expected to operate at LOS "F" at Kahekili Highway/Kamehameha Highway in Kahaluu. Kamehameha Highway is expected to operate at LOS "E", with a v/c ratio of 0.61, in the Kahaluu area.

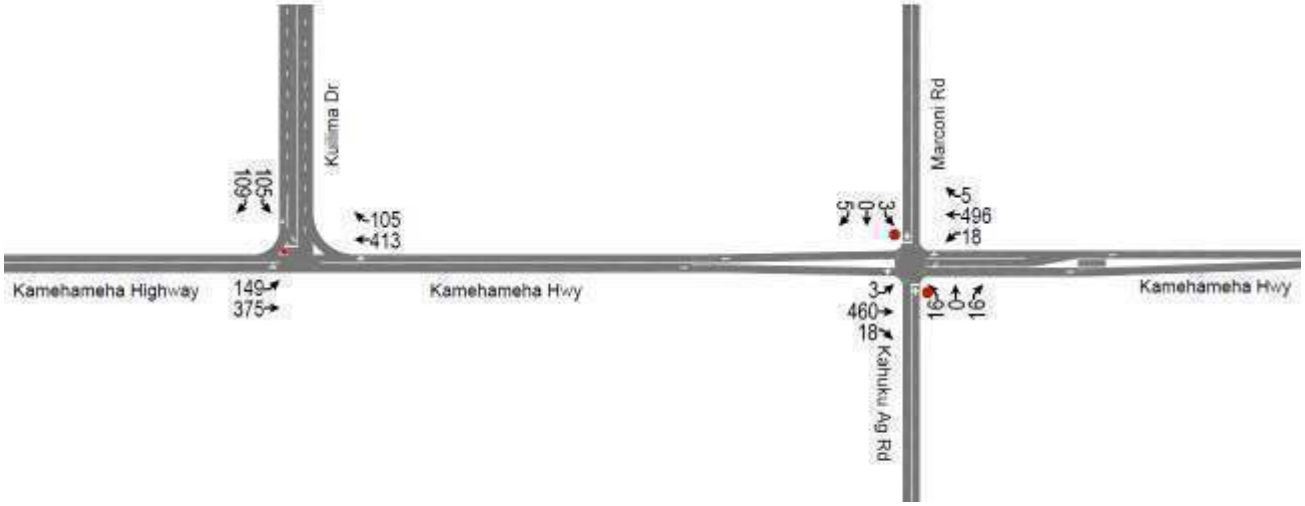
Table 6 summarizes the Kamehameha Highway two-lane traffic operations for the peak hours of traffic without the Proposed Action. Table 7 summarizes the intersection analysis for the peak hours of traffic without the Proposed Action. Figure 12 depicts the Year 2025 weekend peak hour traffic without the Proposed Action.

Table 6. Peak Hour Two-Lane Operations on Kamehameha Highway Without Proposed Action

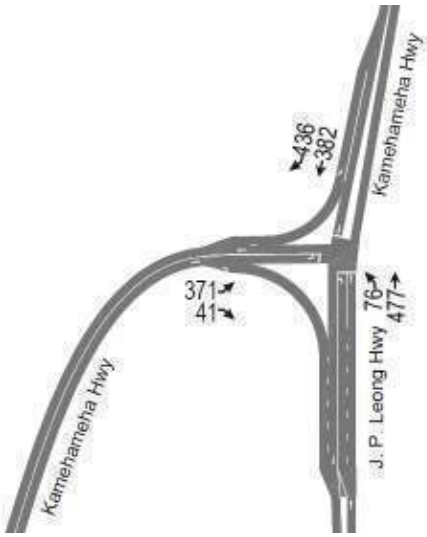
Peak Hour	Location	LOS	v/c
Weekday AM	Haleiwa	E	0.38
	Kahuku	E	0.22
	Kahaluu	E	0.51
Weekday PM	Haleiwa	E	0.52
	Kahuku	E	0.33
	Kahaluu	E	0.60
Weekend	Haleiwa	E	0.57
	Kahuku	E	0.35
	Kahaluu	E	0.61

Table 7. Intersection Traffic Analysis Summary - Peak Hour Conditions Without Proposed Action

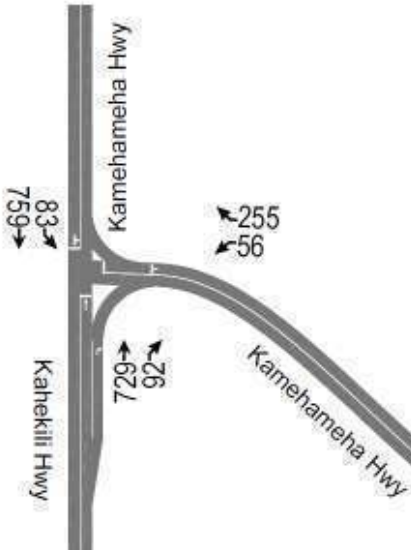
Scenario	Kamehameha Hwy Intersection	MOE	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	Intersection
2025 AM Peak Hour of Weekday Traffic Without Proposed Action	Kuilima Drive	LOS	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	C	N/A	B	A
		Delay	8.2	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	20.2	N/A	10.5	4.2
		v/c	0.09	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.27	N/A	0.13	N/A
	Marconi Rd	LOS	C	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A			A
		Delay	16.1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	8.8			1.4
		v/c	0.12	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.02			N/A
	Joseph P. Leong Hwy	LOS	C	N/A	A	N/A	N/A	N/A	C	A	N/A	N/A	B	A	B
		Delay	25.4	N/A	0.2	N/A	N/A	N/A	29.2	8.5	N/A	N/A	14.6	3.7	13.3
		v/c	0.67	N/A	0.05	N/A	N/A	N/A	0.35	0.30	N/A	N/A	0.32	0.42	N/A
	Kahekili Hwy	LOS	N/A	N/A	N/A	E			N/A	N/A	N/A	B	N/A	N/A	F
		Delay	N/A	N/A	N/A	39.3			N/A	N/A	N/A	14.8	N/A	N/A	403.2
		v/c	N/A	N/A	N/A	N/A			N/A	N/A	N/A	0.65	N/A	N/A	N/A
2025 PM Peak Hour of Weekday Traffic Without Proposed Action	Kuilima Drive	LOS	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	E	N/A	B	A
		Delay	9.0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	36.8	N/A	12.9	4.4
		v/c	0.12	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.41	N/A	0.21	N/A
	Marconi Rd	LOS	C	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A			A
		Delay	22.7	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	9.2			1.5
		v/c	0.19	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.03			N/A
	Joseph P. Leong Hwy	LOS	C	N/A	A	N/A	N/A	N/A	C	A	N/A	N/A	B	A	B
		Delay	26.6	N/A	0.1	N/A	N/A	N/A	31.2	9.4	N/A	N/A	14.7	3.3	13.3
		v/c	0.72	N/A	0.03	N/A	N/A	N/A	0.30	0.41	N/A	N/A	0.52	0.44	N/A
	Kahekili Hwy	LOS	N/A	N/A	N/A	F			N/A	N/A	N/A	B	N/A	N/A	B
		Delay	N/A	N/A	N/A	60.5			N/A	N/A	N/A	10.4	N/A	N/A	11.1
		v/c	N/A	N/A	N/A	0.92			N/A	N/A	N/A	0.12	N/A	N/A	N/A
2025 Weekend Peak Hour of Traffic Without Proposed Action	Kuilima Drive	LOS	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	F	N/A	B	A
		Delay	9.1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	70.8	N/A	13.2	9.4
		v/c	0.15	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.75	N/A	0.25	N/A
	Marconi Rd	LOS	C	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A			A
		Delay	22.5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	9.3			1.1
		v/c	0.15	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.02			N/A
	Joseph P. Leong Hwy	LOS	C	N/A	A	N/A	N/A	N/A	D	B	N/A	N/A	B	A	B
		Delay	28.7	N/A	0.7	N/A	N/A	N/A	47.1	12.7	N/A	N/A	19.8	4.5	16.7
		v/c	0.79	N/A	0.10	N/A	N/A	N/A	0.57	0.52	N/A	N/A	0.57	0.55	N/A
	Kahekili Hwy	LOS	N/A	N/A	N/A	F			N/A	N/A	N/A	B	N/A	N/A	C
		Delay	N/A	N/A	N/A	103.9			N/A	N/A	N/A	10.6	N/A	N/A	15.5
		v/c	N/A	N/A	N/A	1.04			N/A	N/A	N/A	0.14	N/A	N/A	N/A



Project Vicinity



Haleiwa



Kahaluu

Legend

Lane Controls

137→ **Traffic Movement Volume (vph)**

Figure 12. Year 2025 Weekend Peak Hour Traffic Without the Proposed Action

V. Trip Generation Analysis

A. Trip Generation Methodology

The Institute of Transportation Engineers (ITE) has developed trip generation rates for various land use activities, which are published in Trip Generation, 8th Edition. The ITE trip generation methodology was developed from actual data from trip generation studies conducted at developed sites throughout the country and compiled into regression equations or weighted average rates.

While ITE has developed trip rates for a wide variety of land use activities, it cannot account for local characteristics that can have a significant effect on travel behavior, such proximity to employment and shopping opportunities, highway access, transit service, and demographics. The range of data that ITE analyzed reflects the wide variation in travel patterns from the same land use activity in different parts of the country. In lieu of more locally valid data, the ITE trip generation methodology is generally accepted by government agencies and widely used throughout the transportation engineering profession for traffic impact analysis of new developments.

When analyzing the traffic impacts an expansion of an existing development, site-specific trip generation data can be collected from the existing development and applied to the future expansion. Such is the case with the Turtle Bay Resort Master Plan, where the proposed land uses are essentially the same character as the existing Resort, and where most of the local characteristics that affect travel behavior will remain the same. In these cases, ITE recommends the use of local trip generation rates where available to estimate traffic from the new or expanded development. Accordingly, the study has developed trip generation rates, which are based upon locally-collected data from existing land uses and further discussed in the following sections. The ITE methodology was used where the local trip data were not available.

1. Resort Hotel

The existing Turtle Bay Hotel and future hotels in the Turtle Bay Resort Master Plan fall under the ITE category of resort hotel. ITE did not develop a weekday trip rate for a resort hotel. ITE Saturday trip data for a resort hotel were limited to one observation. During the pre-consultation meetings with DOT, it was agreed that the existing trip generation from the Turtle Bay Hotel would provide the most relevant source for estimating traffic volumes from new hotel rooms in the Proposed Action and the three (3) Alternatives.

2. Resort Residential Development

Kuilima Estates and the resort residential units in the Turtle Bay Resort Master Plan can be described under the ITE category of recreational homes. However, DOT has expressed concern over the use of the ITE recreational home trip rates to analyze the traffic impacts of resort residential units. It was agreed that travel characteristics

of the Kuilima Estates were uniquely suited to develop trip generation rates for the resort residential units in the Proposed Action and the three (3) Alternatives.

3. Timeshare Hotel

The Proposed Action, the Full Build Out Alternative, and the Conservation Partner Alternative includes timeshare hotel rooms, in addition to traditional and/or condo-hotel rooms. ITE describes timeshare as developments, where each unit may be purchased by multiple owners with rights of use for specific time periods each year. While the original timeshares were often developed as recreational condominiums or vacation homes, the timeshares for the Turtle Bay Resort Master Plan are planned to be developed as full service hotels, similar to the Aulani Disney Resort in Ko Olina, with vacation club (timeshare) units and traditional hotel rooms. Therefore, the ITE weekday trip rates for timeshares were used to analyze the timeshare hotels in the Proposed Action and the three (3) Alternatives. Since ITE did not provide Saturday trip rates for timeshares, the weekday trip rates for the timeshare hotels were adjusted by ratio between Saturday and the average weekday trip rates developed from the Turtle Bay Hotel trip generation study, as discussed in the following section. The average daily trip rates for the proposed timeshares were derived from the following ITE regression equations:

$$Ln(T) = 1.06 \times Ln(X) + 2.09 \text{ (Weekday Traffic)}$$

$$Ln(T) = 1.06 \times Ln(X) + 2.09 \times \frac{\text{Turtle Bay Hotel Saturday Rate}}{\text{Turtle Bay Hotel Weekday Rate}} \text{ (Saturday Traffic)}$$

where, Ln = natural logarithm function

T = average vehicle trip ends

X = number of occupied rooms

4. Shopping Center

The average daily trip rates for the proposed shopping village or "gathering place" were derived from the following ITE regression equations:

$$Ln(T) = 0.65 \times Ln(X) + 5.73 \text{ (Weekday Traffic)}$$

$$Ln(T) = 0.63 \times Ln(X) + 6.23 \text{ (Saturday Traffic)}$$

where, Ln = natural logarithm function

T = average vehicle trip ends

X = 1,000 square feet of gross leasable floor area

ITE developed hourly variation of shopping center traffic for both the average weekday and Saturdays, which were expressed as percentages of 24-hour traffic for

each hour from 10 AM to 10 PM. The hourly variations were applied to the average weekday and Saturday traffic to determine the hourly traffic volumes.

The total trips generated by a shopping center can be defined as driveway trips, i.e., traffic entering and exiting the project site. A percentage of the peak hour trips generated by a shopping center are considered to be "pass-by" trips, i.e., traffic already on the road stopping at a "secondary" destination. The "new" or primary trips are trips where the primary destination is the shopping center. ITE compiled data from traffic studies that correlated pass-by trips with the gross leasable floor areas of the shopping centers. The results of the analysis were published in the Trip Generation Handbook, June 2004. The ITE average shopping centers pass-by trip percentages of 34 percent and 26 percent, during the weekday PM and Saturday peak periods of traffic, respectively, applied to the hourly traffic volumes generated by the shopping village. Since the shopping village will be planned to cater to Resort guests and residents, and will be located well within the Resort and not directly on Kamehameha Highway, it was assumed that the pass-by trips would be comprised of the Resort guests and residents and not from traffic passing on Kamehameha Highway.

5. Multi-Family (Community) Housing

The Proposed Action and the three (3) Alternatives are expected to include affordable multi-family (community) housing. The community housing is expected to be developed as rental apartment units and/or owner-occupied condominium units. For the purpose of this traffic impact analysis, the ITE trip generation rates for the apartment use were applied to the affordable housing units, since it is more conservative (higher) than the residential condominium use. The ITE peak hour of generator rates were used instead of the peak hour of adjacent street traffic rates, which applies to commuter peak hour traffic. The peak hour trip rates for the rental apartment were derived from the following regression equations:

$T = 0.54 \times X + 2.45$ (AM Peak Hour of Weekday Traffic)

$T = 0.60 \times X + 14.91$ (PM Peak Hour of Weekday Traffic)

$T = 0.41 \times X + 19.23$ (Saturday Peak Hour of Traffic)

where, T = average vehicle trip ends

X = number of dwelling units

6. Recreational Uses

The Proposed Action and the three (3) Alternatives are expected to maintain over 500 acres of open space in the form of the two existing golf courses, beach parks, a wildlife preserve and bird sanctuary, and an equestrian center. The trip generation for the existing golf courses is already included in the existing traffic count data. The average ITE trip rates for beach parks of 0.48 trip per acre, 0.60 trip per acre, and

1.18 trips per acre were used to analyze parks which front the ocean, during the AM, PM, and Weekend peak hours of traffic, respectively.

For lack of specific ITE trip rates for the wildlife preserve, the bird sanctuary, and the equestrian center, the ITE land use designation of County Park was used to represent these uses. The average ITE trip rates for county parks of 0.52 trip per acre, 0.59 trip per acre, and 2.24 trips per acre were used to analyze the various recreational uses, during the AM, PM, and Weekend peak hours of traffic, respectively.

B. Turtle Bay Resort Trip Generation Study

A trip generation study was conducted at the existing Turtle Bay Resort from October 30, 2011 through November 6, 2011, in accordance with ITE recommended practice published in the Trip Generation Handbook, Second Edition. The purpose of the study was to develop trip generation characteristics for "local" trip generation rates for resort hotels and resort residential development in the Turtle Bay Resort Master Plan.

Traffic count data were collected on Kuilima Drive at Kamehameha Highway and at the Turtle Bay Hotel entrance. The traffic count data were reduced to 5-minute intervals to account for internal trips. The differences between the traffic count data at Kamehameha Highway and at the entrance to the Hotel were assumed to be Kuilima Estates trips. Where differences were negative values, the trips were considered internal circulation between the Turtle Bay Hotel and Kuilima Estates, and were not included in the trip generation rates. The Turtle Bay Hotel and Kuilima Estates traffic were correlated with the daily occupancies, which were reported by the Hotel and a rental management company for Kuilima Estates, respectively.

The SMS travel survey discovered a very unique trip generation characteristic of the Turtle Bay Hotel, i.e., pass-by trips, which are normally associated with shopping centers. The Turtle Bay Hotel is located at the farthest point from Waikiki, the Honolulu International Airport, and the population centers of Oahu. It is situated between two of the most popular destinations on Oahu, the Polynesian Cultural Center to the east, and the world famous surfing beaches on the North Shore to the west. The Turtle Bay Hotel has become a well-known rest stop for both visitors and residents driving around island. The SMS survey indicated that over 17 percent of respondents identified themselves as Oahu residents visiting the Resort. The SMS data excluded the residents who were attending special events held at the Resort during the survey period. Tourists visiting the Resort (non-guests) made up an additional 13 percent of the total respondents for a total of 30 percent of the hotel trips. Taking a conservative approach, the visiting tourists were excluded from the pass-by trips, since the future Turtle Bay Resort Master Plan may become a primary destination for tourists driving around the island. The Oahu residents were classified as "Resort pass-by trips", i.e., trips bound for other primary destinations in the region, who take a rest stop at the Resort. Based upon the SMS travel survey, there were an estimated 500 pass-by trips per weekday that stopped or departed the Turtle Bay Hotel between the hours of 8:00 AM and 6:00 PM. During the weekend, the pass-by traffic increased to 920 vehicles per day.

The Oahu resident pass-by trips were deducted from the hotel trip rates and analyzed separately. It was more reasonable to assume that the pass-by trips were a function of the volume of traffic passing on Kamehameha Highway, rather than the number of occupied rooms at the Turtle Bay Hotel. Therefore, the increase in pass-by trips was based upon the regional growth in traffic on Kamehameha Highway. The ITE timeshare trip rates also were adjusted for the pass-by trip rates observed at the Turtle Bay Hotel.

To ensure a more conservative technical analysis and to account for potential deviation between the existing trip generation characteristics and future travel behavior, the Turtle Bay Hotel and Kuilima Estates trips rates were uniformly increased by 10 percent, per the recommendation of DOT staff. Tables 8 and 9 summarize the trip generation data for the Turtle Bay Hotel and the Kuilima Estates, respectively.

Table 8. Existing Turtle Bay Hotel Daily Trip Generation Rate Calculations

Day of the Week	**Mon**	**Tue**	**Wed**	**Thu**	**Fri**	**Sat**
Volume (trips/day)	3,038	3,058	3,122	3,464	3,916	3,936
Occupied Rooms	381	367	360	413	470	478
Occupancy	76 %	73 %	72 %	83 %	94 %	96 %
Daily Trips per Occupied Room	7.97	8.33	8.67	8.39	8.33	8.23
	Weighted Weekday Average = 8.34					8.23
Pass-By Trip Reduction	7.08					6.31
+10% Adjustment Factor	7.79					6.94

Table 9. Existing Kuilima Estates Daily Trip Generation Rate Calculations

Day of the Week	**Mon**	**Tue**	**Wed**	**Thu**	**Fri**	**Sat**
Volume (trips/day)	727	722	622	866	918	820
Occupied Units	165	206	203	230	227	206
Occupancy	45 %	56 %	55 %	63 %	62 %	56 %
Daily Trips per Occupied Unit	4.41	3.50	3.06	3.77	4.04	3.98
	Weighted Weekday Average = 3.74					3.98
+10% Adjustment Factor	4.11					4.38

Kamehameha Highway, in the vicinity of Turtle Bay Resort, carries the lowest traffic volumes in the study area. It is reasonable to assume that the peak hour traffic from the Resort will determine when the peak hours of traffic on Kamehameha Highway are expected to occur. The trip generation characteristics are expressed in terms of daily trips, which are distributed throughout the day on an hourly basis, based upon the trip

generation study. The hourly volumes are added to the future Kamehameha Highway traffic to determine when the peak hours of traffic will occur.

C. Farmers Market Trip Generation Study

A trip generation study was conducted at the Haleiwa Farmers Market at the intersection of Kamehameha Highway and Joseph P. Leong Highway (North Junction) on Sunday, June 10, 2012 between the hours of 9:00 AM and 3:00 PM. The Haleiwa Farmers Market generated almost 1,200 vehicle trips during the survey period. During the peak hour of traffic, the Haleiwa Farmers Market generated 275 vph. It should be noted that the trip generation study was conducted on the closing day of the Haleiwa Farmers Market at that location. The trip generation data can be considered to be conservative, i.e., higher than on normal days.

For the purpose of this traffic impact analysis, it was assumed that the Turtle Bay Resort Farmers Market would be comparable to the Haleiwa Farmers Market in terms of trip generation. To remain conservative, the trip generation data for the Farmers Market was applied to both the weekday and weekend operations. The average ITE shopping center pass-by trip rates of 34 percent during weekday peak periods of traffic and 26 percent during the Saturday peak period also was applied the trip rates to account for the Resort guests and residents shopping at the Turtle Bay Resort Farmers Market.

D. Trip Generation Characteristics

During the pre-consultation meetings with DOT, it was agreed that to remain conservative the trip generation for the hotels would be analyzed at 90 percent occupancy during the weekday and 95 percent occupancy on the weekend for the Proposed Action and the three (3) Alternatives, based upon recent occupancies at the Turtle Bay Hotel. It was further agreed that the trip generation for the resort residential development would analyzed at 60 percent occupancy for both the weekday and weekend, which are considered to be conservative based upon recent market data provided by HVS International Consulting and Evaluation.

The Full Build Out Alternative is expected to generate the highest volumes of traffic during the peak hours of traffic with a total of 3,500 new units. The 500-unit Resort Residential Alternative is expected to generate the least amount of peak hour traffic. The Conservation Partner Alternative has the second lowest trip generation estimate with a total of 740 new units. The Proposed Action is expected to generate the second highest peak hour traffic with a total of 1,375 new units. Table 10 summarizes the trip generation characteristics for the Proposed Action and the three (3) Alternatives.

Table 10. Trip Generation Characteristics

Alternative	Area	Land Use	Units/Area	AM Peak Hour				PM Peak Hour				Saturday Peak Hour			
				Enter (vph)	Exit (vph)	Total (vph)	% of Total	Enter (vph)	Exit (vph)	Total (vph)	% of Total	Enter (vph)	Exit (vph)	Total (vph)	% of Total
Proposed Action	H-1a, H-2	Timeshare Hotel	350	79	93	171	17%	130	130	259	25%	83	97	180	12%
	H-1b, H-2a	Hotel	275	56	65	121	12%	90	75	165	16%	63	71	134	9%
	RR-1, RR-2a, RR-2b, RR-3a, RR-3b, RR-4a, RR-4b, RR-5, RR-6	Resort Residences	590	38	43	81	8%	57	50	106	10%	46	66	112	8%
	RES-1, RES-2	Apartment	160	26	63	89	9%	68	43	111	11%	46	39	85	6%
	Gathering Place	Shopping Center	40,000 SFGLFA	94	104	198	20%	113	102	215	21%	184	176	360	24%
	Farmers Market	Farmers Market	7.5 Acres	98	83	181	18%	3	9	11	1%	80	90	170	12%
	P-1, P-2, P-4, P-5	Beach Park	~~47.6~~ 63.4 Acres	56	39	95	10%	29	57	86	8%	76	89	165	11%
	P-3, Wildlife Preserve, Equestrian Center	County Park	118.6 Acres	44	18	62	6%	24	45	70	7%	157	109	266	18%
	Proposed Action Total Traffic			**491**	**508**	**998**	**100%**	**514**	**511**	**1023**	**100%**	**735**	**737**	**1472**	**100%**
Full Build Out	H-1, H-4, H-5	Hotel	1,578	321	377	698	38%	530	446	976	43%	355	409	764	32%
	H-2, H-3	Timeshare Hotel	913	217	257	474	26%	354	342	696	31%	230	269	499	21%
	RR-1a, RR-1b, RR-2, RR-3, RR-4	Resort Residences	910	58	66	124	7%	97	70	167	7%	71	102	173	7%
	RES-1	Apartment	90	15	36	51	3%	42	27	69	3%	30	26	56	2%
	Gathering Place	Shopping Center	40,000 SFGLFA	94	104	198	11%	112	96	208	9%	184	176	360	15%
	TMK: 5-7-006: Por, 001	Farmers Market	3.4 Acres	98	83	181	10%	2	13	15	1%	80	90	170	7%
	P-1, P-2, P-4, Beach Club	Beach Park	44.8 Acres	39	27	66	4%	21	40	61	3%	54	63	117	5%
	P-3, Wildlife Preserve, Equestrian Center	County Park	114.8 Acres	42	17	60	3%	24	44	68	3%	152	105	257	11%
	Full Build Out Alternative Total Traffic			**884**	**967**	**1852**	**100%**	**1182**	**1078**	**2260**	**100%**	**1156**	**1240**	**2396**	**100%**
Resort Residential	RR-1, RR-2a, RR-2b, RR-3a, RR-3b, RR-4a, RR-4b, RR-5, RR-6, RR--7, RR-8, RR-9	Resort Residences	454	29	33	62	10%	29	34	63	13%	18	49	67	6%
	RES-1	Apartment	46	8	19	27	4%	26	17	43	9%	21	18	38	4%
	Shopping Village	Shopping Center	40,000 SFGLFA	94	104	198	32%	114	101	215	45%	184	176	360	35%
	TMK: 5-7-006: Por, 001	Farmers Market	3.4 Acres	98	83	181	30%	2	8	10	2%	69	97	166	16%
	P-1, P-2, P-4, Beach Club	Beach Park	56.1 Acres	49	34	84	14%	26	50	76	16%	67	79	146	14%
	P-3, Wildlife Preserve, Equestrian Center	County Park	114.8 Acres	42	17	60	10%	24	44	68	14%	152	105	257	25%
	Resort Residential Alternative Total Traffic			**320**	**290**	**612**	**100%**	**221**	**254**	**475**	**100%**	**511**	**524**	**1034**	**100%**
Conservation Partner	H-1	Timeshare Hotel	250	54	64	118	15%	92	83	175	23%	58	61	119	10%
	H-2	Hotel	190	40	45	85	11%	63	51	114	15%	44	46	90	7%
	RR-1, RR-2, RR-3, RR-4	Resort Residences	252	16	19	35	4%	25	21	46	6%	11	28	39	3%
	RES-1	Apartment	48	8	~~66~~ 20	28	4%	27	~~66~~ 17	44	6%	21	~~66~~ 18	39	3%
	Gathering Place	Shopping Center	40,000 SFGLFA	94	104	198	25%	114	101	215	29%	184	176	360	30%
	Farmers Market	Farmers Market	6.6 Acres	98	83	181	23%	2	8	10	1%	69	97	166	14%
	P-1, P-2, P-4	Beach Park	52.4 Acres	46	33	81	10%	25	49	74	10%	70	79	149	12%
	P-3, Wildlife Preserve, Equestrian Center	County Park	113.2 Acres	42	17	59	7%	23	43	67	9%	150	104	254	21%
	Conservation Partner Alternative Total Traffic			**398**	**431**	**785**	**100%**	**372**	**422**	**745**	**100%**	**607**	**657**	**1216**	**100%**

VI. Trip Distribution

A. Travel Survey

SMS conducted an extensive week-long travel survey at the Turtle Bay Resort from Monday, October 31, 2011 through Sunday, November 6, 2011. The travel survey consisted of personal interviews of about 4,800 motorists that entered and exited the Turtle Bay Hotel and Kuilima Estates. The purpose of the travel survey was to determine the origins and destinations of the trips arriving at and departing from the Resort. The trip distribution for this traffic impact analysis was determined from the findings of the travel survey. The methodology and results of the travel survey was documented by SMS in the Quantification of Turtle Bay Resort Traffic Patterns Report, dated December, 2011.

According to the SMS survey, about 43 percent of the Turtle Bay Resort traffic entered or exited the study area, i.e., with origins or destinations in Honolulu, Central Oahu, and Leeward Oahu. About 39 percent of the Turtle Bay Resort traffic remained within the limits of the field investigation, which extended from Haleiwa to Kahaluu. The remaining 18 percent were contained within the fringes of the study area in Haleiwa/Waialua and Windward Oahu.

B. Trip Distribution

The SMS travel survey data were further disaggregated by time period to determine the trip distribution during the peak hours of traffic. The trip distribution for Turtle Bay Hotel traffic was applied to the proposed hotels, and the trip distribution of Kuilima Estates traffic was applied to proposed resort residential developments. The trip distribution of traffic generated by other land uses in the Proposed Action and the three (3) Alternatives were based upon existing peak hour traffic patterns. Table 11 summarizes the trip distribution patterns for the Proposed Action and the three (3) Alternatives in terms of the percentages (%) of total site traffic on Kamehameha Highway along the project site frontage (local traffic) and at the limits of the study area in Haleiwa and Kahaluu.

Table 11. Trip Distribution Summary								
Alternative	**Local vs. Regional**	**Direction**	**AM Peak Hr**		**PM Peak Hr**		**Weekend Peak Hr**	
			Enter	**Exit**	**Enter**	**Exit**	**Enter**	**Exit**
Proposed Action	**Local Traffic**	**EB**	59%	46%	53%	41%	57%	42%
		WB	41%	54%	47%	59%	43%	58%
	Regional Traffic	**Haleiwa**	23%	22%	25%	26%	24%	24%
		Kahaluu	13%	11%	13%	14%	13%	9%
Full Build Out	**Local Traffic**	**EB**	61%	45%	52%	38%	56%	42%
		WB	39%	55%	48%	62%	44%	58%
	Regional Traffic	**Haleiwa**	35%	32%	34%	36%	44%	35%
		Kahaluu	15%	11%	13%	15%	26%	15%
Resort Residential	**Local Traffic**	**EB**	57%	47%	54%	43%	57%	42%
		WB	43%	53%	46%	57%	43%	58%
	Regional Traffic	**Haleiwa**	17%	18%	18%	21%	22%	22%
		Kahaluu	12%	12%	13%	15%	9%	7%
Conservation Partner	**Local Traffic**	**EB**	59%	46%	54%	42%	57%	41%
		WB	41%	54%	46%	58%	43%	59%
	Regional Traffic	**Haleiwa**	22%	21%	25%	27%	25%	23%
		Kahaluu	13%	12%	13%	15%	12%	8%

VII. Traffic Impact Analysis

A. Traffic Improvements

Based upon the conditions in the Unilateral Agreement and Declaration for Conditional Zoning, the following traffic improvements are required at each of the proposed access intersections on Kamehameha Highway:

1. Widen westbound Kamehameha Highway to provide an exclusive right-turn lane.
2. Widen eastbound Kamehameha Highway to provide an exclusive left-turn lane.
3. Widen westbound Kamehameha Highway to provide a right-turn acceleration lane.
4. Construct separate left-turn and right-turn lanes on side street approaches at Kamehameha Highway.

5. Construct a shared left-turn/through lane and an exclusive right-turn lane on Marconi Road at Kamehameha Highway, if the future Kahuku Mauka Agricultural Road is constructed at the time of improvement.

6. Construct bus turnouts in both directions on Kamehameha Highway at each intersection.

7. Signalize the intersections at Kamehameha Highway, when warranted, with protected left-turn phases on Kamehameha Highway.

The intersection of Kuilima Drive and Kamehameha Highway meets traffic signals warrants under existing conditions. The Kuilima Drive intersection would be signalized along with the construction of the auxiliary turning lanes during the initial phase of the Proposed Action or one of the Alternative development plan.

The auxiliary lane improvements at the intersection of Kamehameha Highway and Kaihalulu Drive should be constructed when it is first open to the public. A median left-turn refuge lane should be constructed on the east leg of Kamehameha Highway to facilitate the left-turn movement from Kaihalulu Drive under unsignalized control.

The auxiliary lane improvements at the intersection of Kamehameha Highway and Marconi Road also should be constructed during the initial phase of development of the Proposed Action or the Alternative development plan. If the Kahuku Mauka Agricultural Road is <u>not</u> constructed opposite of Marconi Road, the intersection should remain unsignalized, and a median left-turn refuge lane should be constructed on the east leg of Kamehameha Highway to facilitate the left-turn movement from Marconi Road.

B. Traffic Impact Analysis of the Alternative Development Plans

1. Alternative Development Plan Phasing

In general, the traffic impact analysis of development plans over five (5) years are analyzed in phases to coordinate the traffic improvements with the proposed development schedule. During the pre-consultation meeting with DOT, it was agreed that the Alternatives will <u>not</u> require phased traffic impact analyses unless one of the Alternatives becomes the preferred plan. At that time, this traffic impact analysis will be updated to reflect the phasing of the new preferred plan.

2. Full Build Out Alternative

The Full Build Out Alternative will require the construction of double left-turn lanes on eastbound Kamehameha Highway at Kaihalulu Drive and at Kuilima Drive. Kaihalulu Drive will require four lanes, two lanes in each direction for the Full Build Out Alternative. The Turtle Bay Resort access road intersections at Kamehameha Highway are expected to operate at overall LOS "C" or better, during the peak hours of traffic with the Full Build Out Alternative. The intersection of Kamehameha Highway and Joseph P. Leong Highway in Haleiwa also is expected to operate at LOS "C" or better, during the peak hours of traffic. In Kahaluu, the left-turn

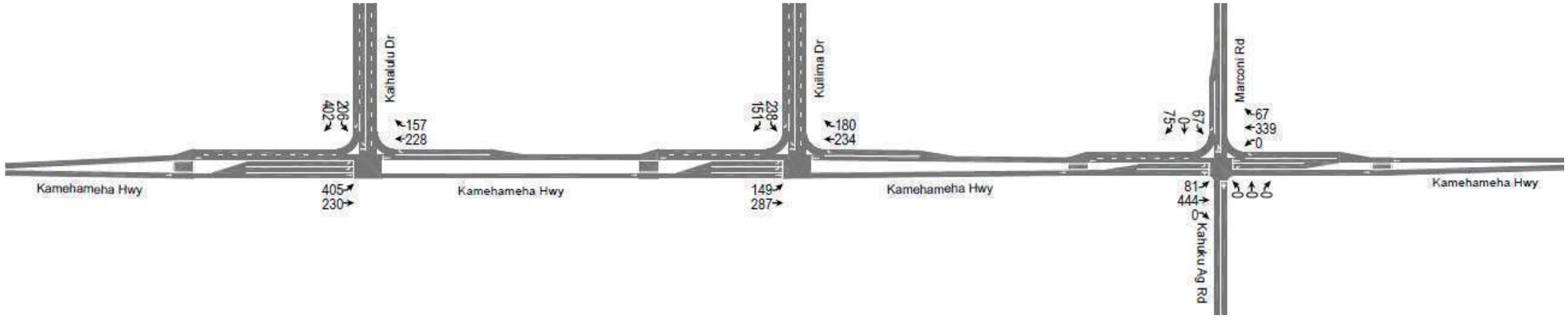
movement from westbound Kamehameha Highway to southbound Kahekili Highway is expected to continue to operate at LOS "F", during the peak hours of traffic. Table 12 summarizes the two-lane traffic analysis of Kamehameha Highway with the Full Build Out Alternative. Table 13 summarizes the intersection analysis for the peak hours of traffic with the Full Build Out Alternative. The AM, PM, and Weekend peak hour assignments of site traffic are depicted on Figures 13, 14, and 15, respectively. Figures 16, 17, and 18 depict the cumulative AM, PM, and Weekend peak hour traffic volumes, respectively, with the Full Build Out Alternative.

Table 12. Peak Hour Two-Lane Operations on Kamehameha Highway With FBO Alternative

Peak Hour	Location	LOS	v/c
Weekday AM	Haleiwa	E	0.62
	Kahuku	E	0.59
	Kahaluu	E	0.61
Weekday PM	Haleiwa	E	0.78
	Kahuku	E	0.73
	Kahaluu	E	0.72
Weekend	Haleiwa	E	0.90
	Kahuku	E	0.79
	Kahaluu	E	0.79

Table 13. Intersection Traffic Analysis Summary - Peak Hour Conditions With FBO Alternative

Scenario	Kamehameha Hwy Intersection	MOE	EBLT	EBTH	EBRT	WBLT	WBTH	WBRT	NBLT	NBTH	NBRT	SBLT	SBTH	SBRT	Intersection
2025 AM Peak Hour of Weekday Traffic With Full Build Out Alternative	Kaihalulu Drive	LOS	C	A	N/A	N/A	C	A	N/A	N/A	N/A	C	N/A	A	C
		Delay	33.9	9.3	N/A	N/A	34.0	4.1	N/A	N/A	N/A	30.3	N/A	7.3	20.9
		v/c	0.68	0.48	N/A	N/A	0.83	0.27	N/A	N/A	N/A	0.52	N/A	0.62	N/A
	Kuilima Drive	LOS	C	B	N/A	N/A	C	A	N/A	N/A	N/A	C	N/A	A	B
		Delay	30.3	11.4	N/A	N/A	22.0	3.4	N/A	N/A	N/A	26.6	N/A	6.0	16.8
		v/c	0.40	0.60	N/A	N/A	0.73	0.28	N/A	N/A	N/A	0.60	N/A	0.33	N/A
	Marconi Rd	LOS	C	B		C	B	A	A			C		A	B
		Delay	32.1	14.7		32.8	18.7	1.6	1.6			25.7		5.6	16.3
		v/c	0.39	0.73		0.21	0.73	0.10	0.18			0.33		0.23	N/A
	Joseph P. Leong Hwy	LOS	C	N/A	A	N/A	N/A	N/A	C	B	N/A	N/A	C	A	B
		Delay	30.6	N/A	0.1	N/A	N/A	N/A	33.7	15.2	N/A	N/A	22.4	5.3	18.1
		v/c	0.83	N/A	0.04	N/A	N/A	N/A	0.41	0.60	N/A	N/A	0.61	0.61	N/A
	Kahekili Hwy	LOS	N/A	N/A	N/A	F			N/A	N/A	N/A	C	N/A	N/A	F
		Delay	N/A	N/A	N/A	>300			N/A	N/A	N/A	19.3	N/A	N/A	50.8
		v/c	N/A	N/A	N/A	>1.2			N/A	N/A	N/A	0.75	N/A	N/A	N/A
2025 PM Peak Hour of Weekday Traffic With Full Build Out Alternative	Kaihalulu Drive	LOS	D	A	N/A	N/A	C	A	N/A	N/A	N/A	D	N/A	C	C
		Delay	47.2	8.3	N/A	N/A	34.5	3.0	N/A	N/A	N/A	38.5	N/A	24.1	26.1
		v/c	0.82	0.51	N/A	N/A	0.87	0.34	N/A	N/A	N/A	0.56	N/A	0.85	N/A
	Kuilima Drive	LOS	D	A	N/A	N/A	C	A	N/A	N/A	N/A	C	N/A	A	C
		Delay	49.9	9.1	N/A	N/A	30.6	2.9	N/A	N/A	N/A	34.7	N/A	7.2	20.7
		v/c	0.74	0.55	N/A	N/A	0.89	0.42	N/A	N/A	N/A	0.68	N/A	0.44	N/A
	Marconi Rd	LOS	D	B		D	C	A	A			D		B	C
		Delay	54.0	14.6		52.0	26.7	2.0	7.0			50.3		11.6	22.9
		v/c	0.55	0.69		0.31	0.89	0.10	0.25			0.54		0.35	N/A
	Joseph P. Leong Hwy	LOS	D	N/A	A	N/A	N/A	N/A	D	B	N/A	N/A	C	A	C
		Delay	47.1	N/A	0.1	N/A	N/A	N/A	49.4	19.3	N/A	N/A	34.2	5.1	25.8
		v/c	0.92	N/A	0.04	N/A	N/A	N/A	0.51	0.70	N/A	N/A	0.83	0.66	0.83
	Kahekili Hwy	LOS	N/A	N/A	N/A	F			N/A	N/A	N/A	B	N/A	N/A	F
		Delay	N/A	N/A	N/A	>300			N/A	N/A	N/A	11.1	N/A	N/A	59.7
		v/c	N/A	N/A	N/A	>1.2			N/A	N/A	N/A	0.15	N/A	N/A	N/A
2025 Weekend Peak Hour of Traffic With Full Build Out Alternative	Kaihalulu Drive	LOS	D	A	N/A	N/A	D	A	N/A	N/A	N/A	D	N/A	C	C
		Delay	49.1	8.5	N/A	N/A	42.0	2.7	N/A	N/A	N/A	46.3	N/A	24.6	29.2
		v/c	0.80	0.56	N/A	N/A	0.94	0.24	N/A	N/A	N/A	0.65	N/A	0.84	N/A
	Kuilima Drive	LOS	D	B	N/A	N/A	C	A	N/A	N/A	N/A	D	N/A	A	C
		Delay	44.8	10.9	N/A	N/A	33.7	2.6	N/A	N/A	N/A	46.8	N/A	7.0	23.6
		v/c	0.64	0.62	N/A	N/A	0.90	0.34	N/A	N/A	N/A	0.81	N/A	0.44	N/A
	Marconi Rd	LOS	D	B		D	D	A	A			D		A	C
		Delay	53.9	16.7		54.1	39.9	2.6	1.0			51.9		9.5	28.6
		v/c	0.71	0.75		0.29	0.94	0.17	0.13			0.67		0.45	N/A
	Joseph P. Leong Hwy	LOS	D	N/A	A	N/A	N/A	N/A	D	C	N/A	N/A	D	A	C
		Delay	48.8	N/A	5.1	N/A	N/A	N/A	53.1	30.9	N/A	N/A	37.6	4.4	29.9
		v/c	0.93	N/A	0.14	N/A	N/A	N/A	0.42	0.88	N/A	N/A	0.88	0.62	N/A
	Kahekili Hwy	LOS	N/A	N/A	N/A	F			N/A	N/A	N/A	B	N/A	N/A	F
		Delay	N/A	N/A	N/A	>300			N/A	N/A	N/A	13.2	N/A	N/A	218.6
		v/c	N/A	N/A	N/A	>1.2			N/A	N/A	N/A	0.23	N/A	N/A	N/A

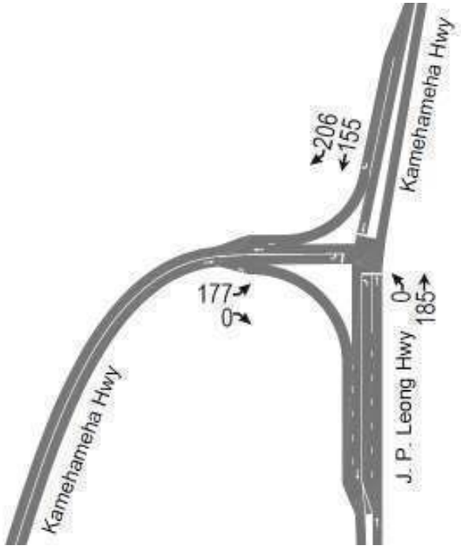


Project Vicinity

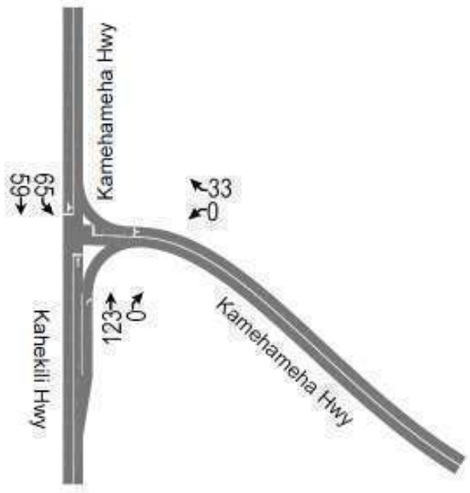
Legend

Lane Controls

137→ **Traffic Movement Volume (vph)**

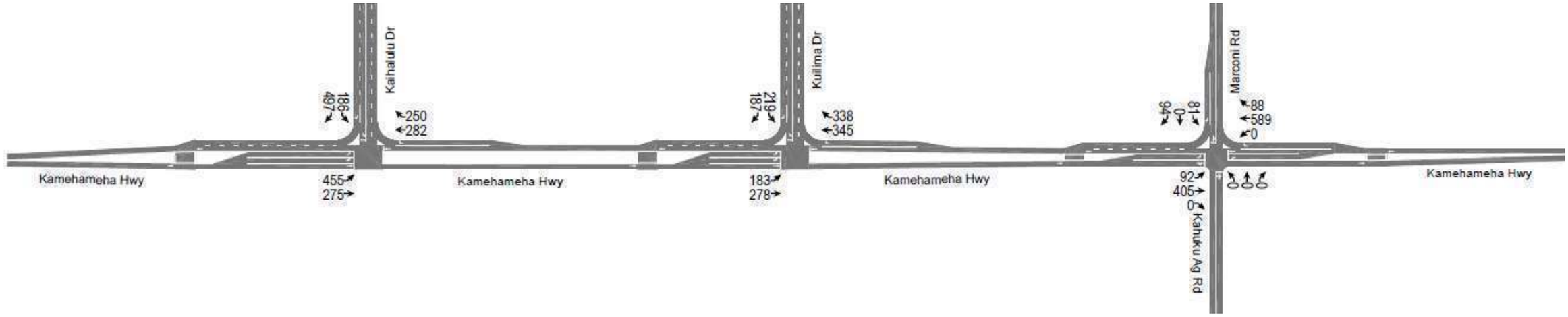


Haleiwa



Kahaluu

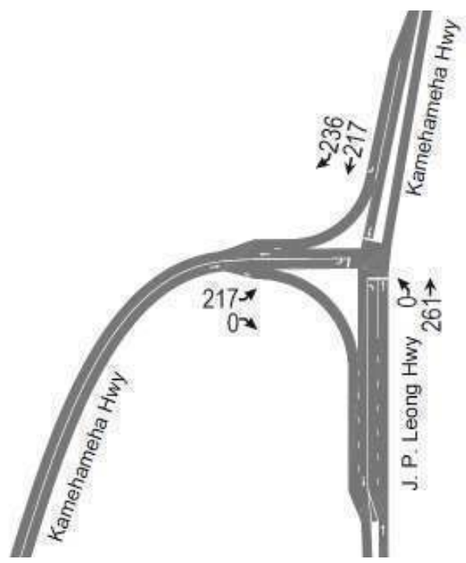
Figure 13. AM Peak Hour Site Traffic Assignment – FBO Alternative



Project Vicinity

Legend

Lane Controls
137→ **Traffic Movement Volume (vph)**



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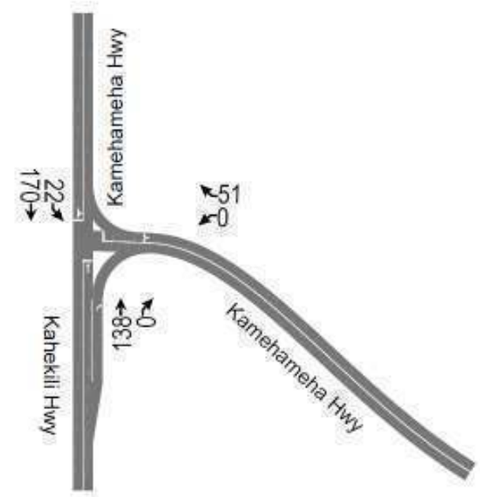
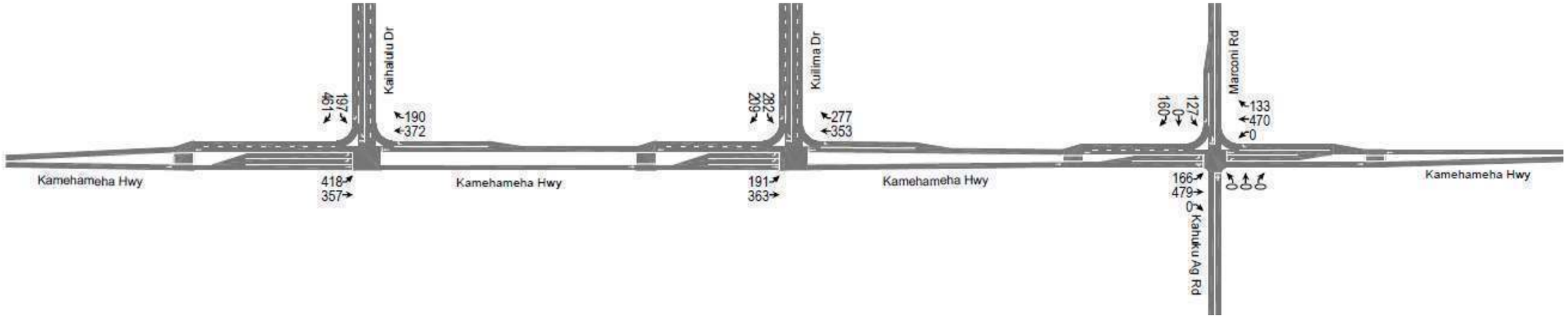


Kahaluu

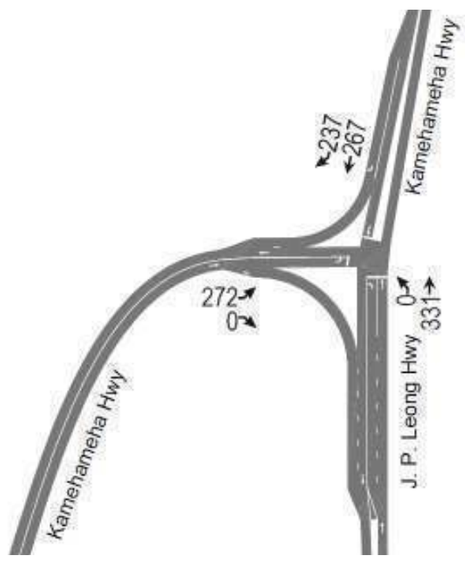
Figure 14. PM Peak Hour Site Traffic Assignment – Full Build Out Alternative



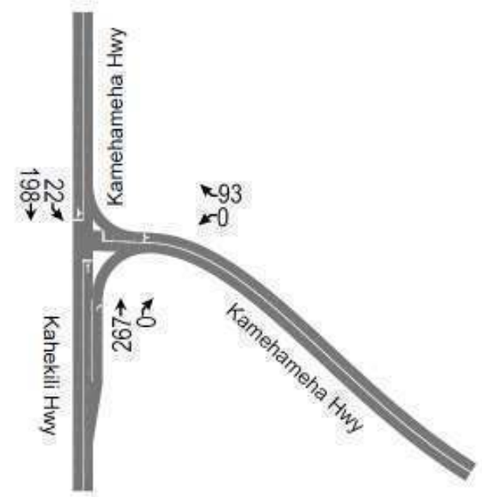
Legend

Lane Controls
137→ **Traffic Movement Volume (vph)**

Project Vicinity

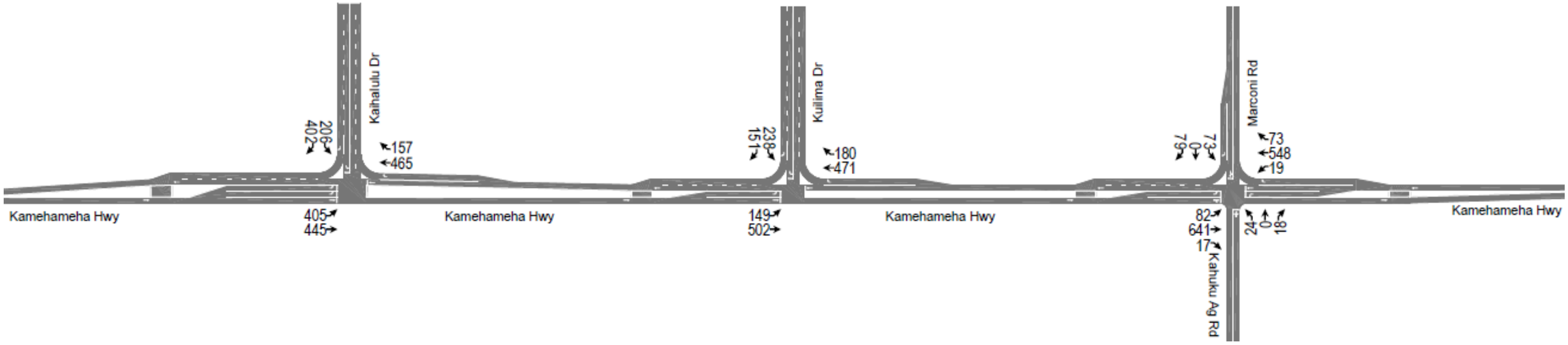


Haleiwa



Kahaluu

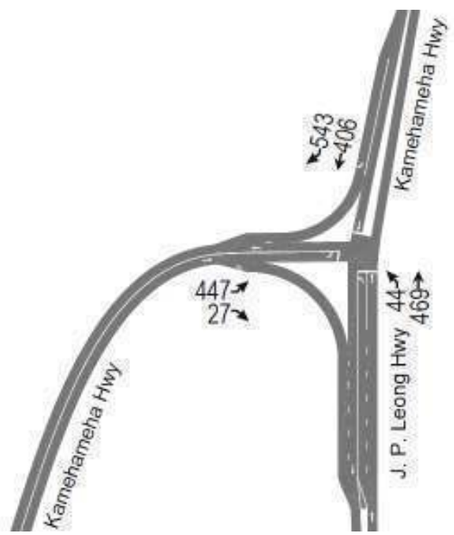
Figure 15. Weekend Peak Hour Site Traffic Assignment – Full Build Out Alternative



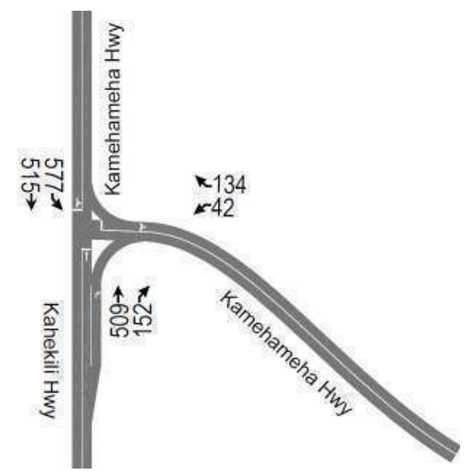
Project Vicinity

Legend

Lane Controls
137→ **Traffic Movement Volume (vph)**

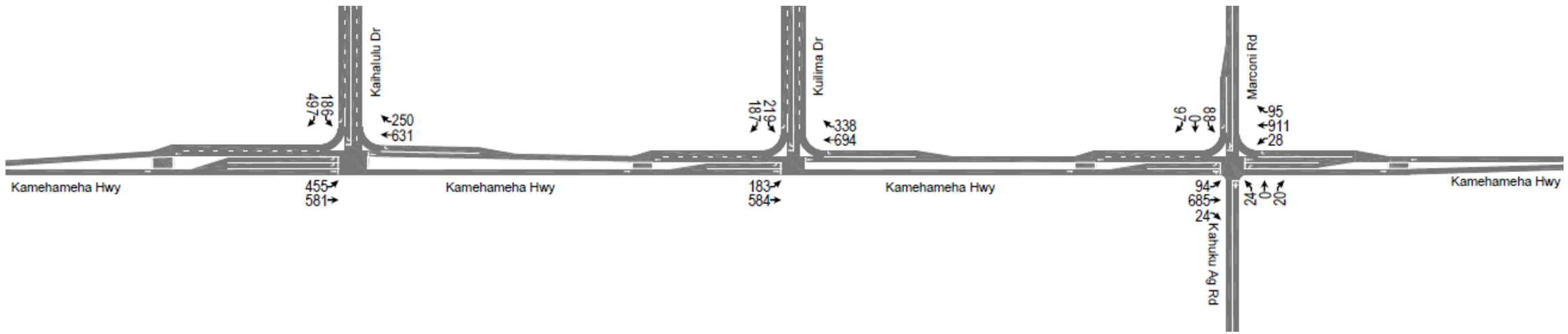


Haleiwa



Kahaluu

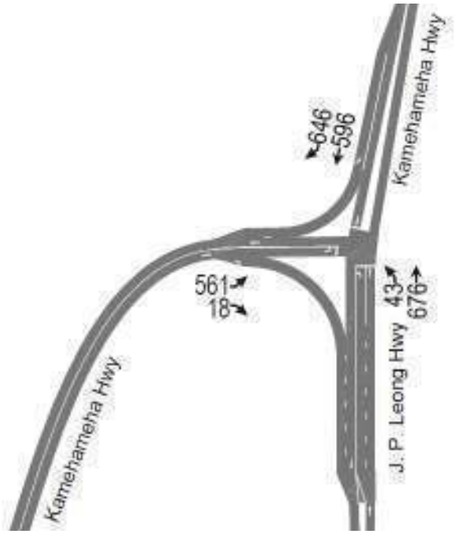
Figure 16. Cumulative AM Peak Hour Traffic FBO Alternative



Legend

Lane Controls
137→ **Traffic Movement Volume (vph)**

Project Vicinity



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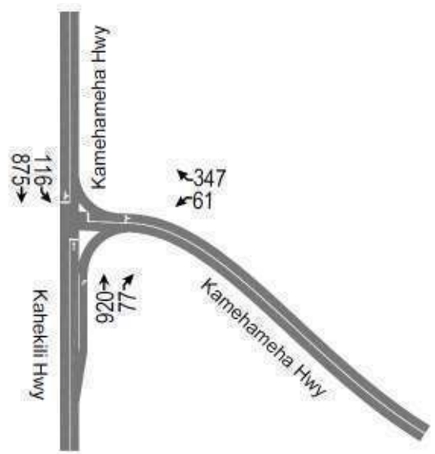
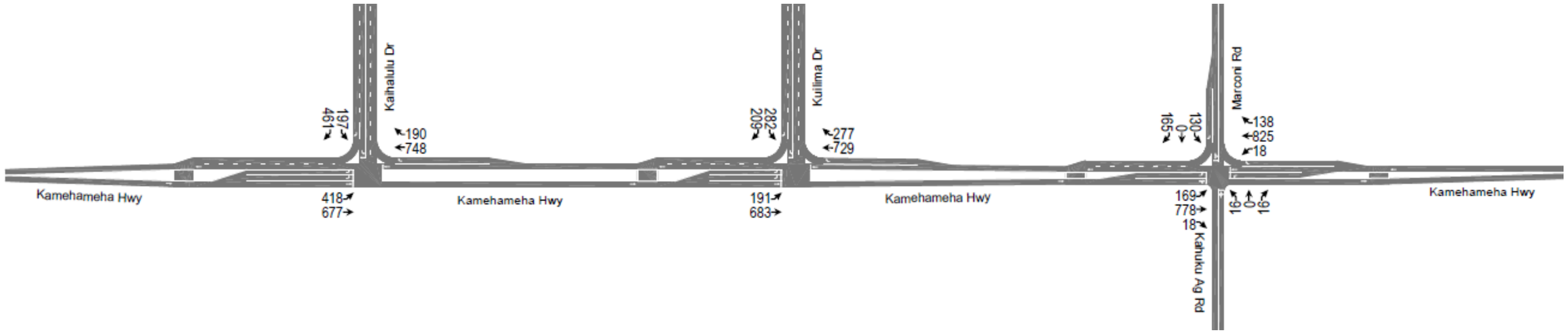


Kahaluu

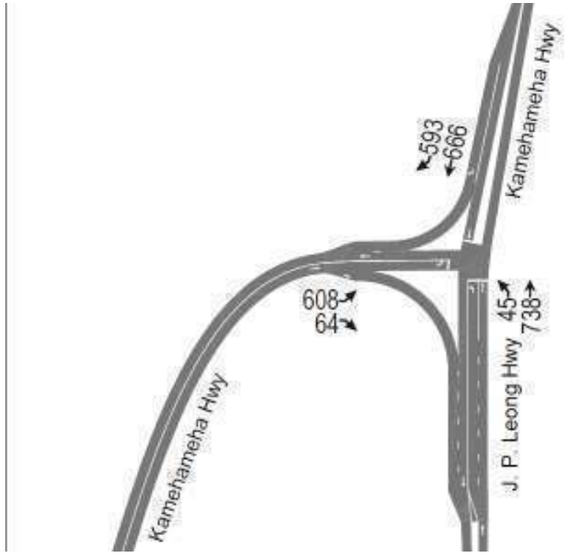
Figure 17. Cumulative PM Peak Hour Traffic FBO Alternative



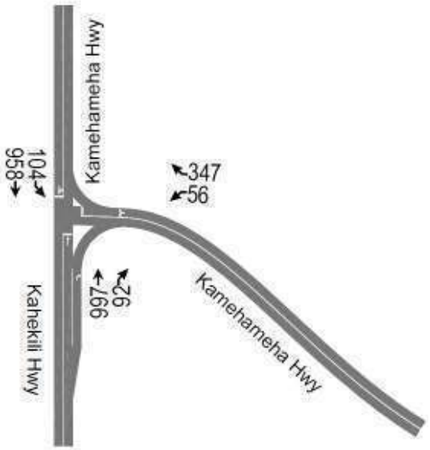
Legend

Lane Controls
137→ **Traffic Movement Volume (vph)**

Project Vicinity



Haleiwa



Kahaluu

Figure 18. Cumulative Weekend Peak Hour Traffic With FBO Alternative

3. Resort Residential Alternative

The Kaihalulu Drive, Kuilima Drive and Marconi Road intersections at Kamehameha Highway are expected to operate at overall LOS "B", during the peak hours of traffic with the Resort Residential (RR) Alternative. In Haleiwa, the intersection of Kamehameha Highway and Joseph P. Leong Highway also is expected to operate at LOS "B", during the peak hours of traffic. The left-turn movement from westbound Kamehameha Highway to southbound Kahekili Highway in Kahaluu is expected to continue to operate at LOS "F" during the peak hours of traffic with the Resort Residential Alternative. Figures 19, 20, and 21 depict the AM, PM, and Weekend assignment of site generated traffic for the Resort Residential Alternative. The cumulative AM, PM, and Weekend peak hour traffic volumes with the Resort Residential Alternative are depicted on Figures 22, 23, and 24, respectively.

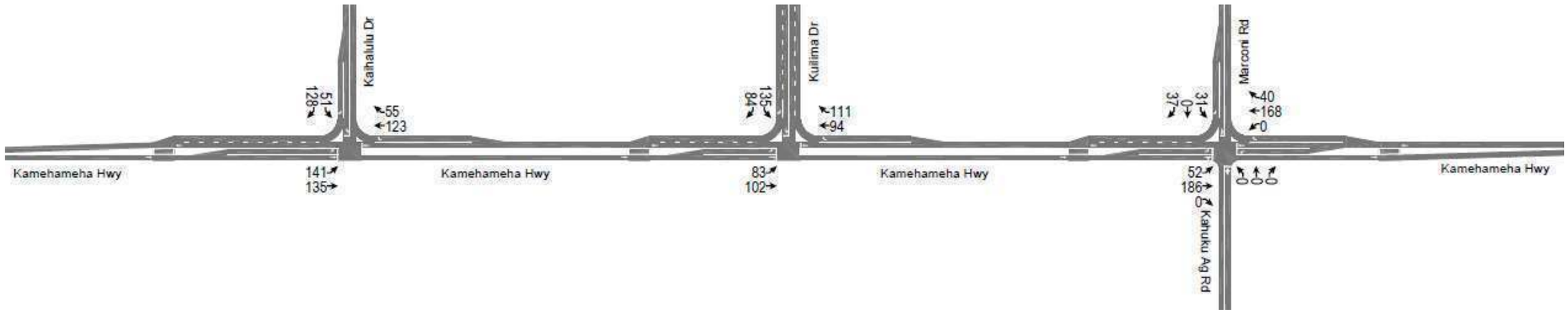
The two-lane traffic analysis of Kamehameha Highway with the Resort Residential Alternative is summarized on Table 14. Table 15 summarizes the intersection analysis for the peak hours of traffic with the Resort Residential Alternative.

Table 14. Peak Hour Two-Lane Operations on Kamehameha Highway With RR Alternative

Peak Hour	Location	LOS	v/c
Weekday AM	Haleiwa	E	0.43
	Kahuku	E	0.34
	Kahaluu	E	0.55
Weekday PM	Haleiwa	E	0.57
	Kahuku	E	0.40
	Kahaluu	E	0.64
Weekend	Haleiwa	E	0.67
	Kahuku	E	0.54
	Kahaluu	E	0.69

Table 15. Intersection Traffic Analysis Summary - 2025 Peak Hour Conditions With Resort Residential Alternative

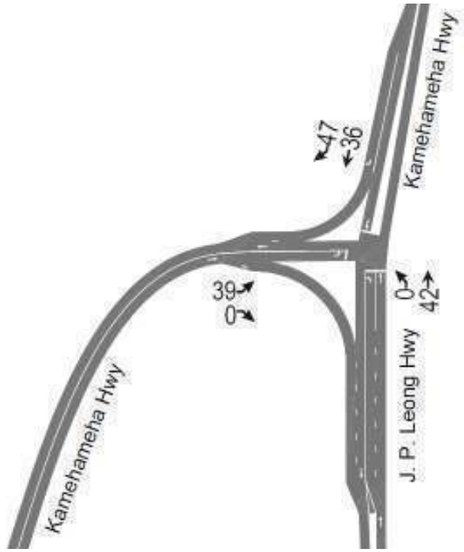
Scenario	Kamehameha Hwy Intersection	MOE	EBLT	EBTH	EBRT	WBLT	WBTH	WBRT	NBLT	NBTH	NBRT	SBLT	SBTH	SBRT	Intersection
2025 AM Peak Hour of Weekday Traffic With Resort Residential Alternative	Kaihalulu Drive	LOS	C	B	N/A	N/A	C	A	N/A	N/A	N/A	B	N/A	A	B
		Delay	33.7	11.3	N/A	N/A	30.7	0.9	N/A	N/A	N/A	15.8	N/A	4.8	19.6
		v/c	0.57	0.48	N/A	N/A	0.77	0.12	N/A	N/A	N/A	0.10	N/A	0.23	N/A
	Kuilima Drive	LOS	C	A	N/A	N/A	B	A	N/A	N/A	N/A	B	N/A	A	B
		Delay	22.0	7.8	N/A	N/A	17.6	4.0	N/A	N/A	N/A	19.5	N/A	3.5	12.7
		v/c	0.28	0.42	N/A	N/A	0.59	0.21	N/A	N/A	N/A	0.37	N/A	0.20	N/A
	Marconi Rd	LOS	B	B		C	B	A	A			B		A	B
		Delay	19.3	10.7		22.8	12.9	0.2	1.1			17.7		0.5	11.2
		v/c	0.18	0.57		0.14	0.57	0.07	0.16			0.14		0.11	N/A
	Joseph P. Leong Hwy	LOS	C	N/A	A	N/A	N/A	N/A	C	B	N/A	N/A	B	A	B
		Delay	24.1	N/A	0.1	N/A	N/A	N/A	28.5	10.1	N/A	N/A	16.7	4.3	13.8
		v/c	0.69	N/A	0.05	N/A	N/A	N/A	0.33	0.37	N/A	N/A	0.39	0.47	N/A
	Kahekili Hwy	LOS	N/A	N/A	N/A	F			N/A	N/A	N/A	C	N/A	N/A	F
		Delay	N/A	N/A	N/A	>300			N/A	N/A	N/A	15.0	N/A	N/A	>300
		v/c	N/A	N/A	N/A	>1.2			N/A	N/A	N/A	0.65	N/A	N/A	N/A
2025 PM Peak Hour of Weekday Traffic With Resort Residential Alternative	Kaihalulu Drive	LOS	C	A	N/A	N/A	C	A	N/A	N/A	N/A	C	N/A	A	B
		Delay	33.7	9.0	N/A	N/A	26.2	0.1	N/A	N/A	N/A	23.9	N/A	7.4	18.2
		v/c	0.43	0.49	N/A	N/A	0.78	0.03	N/A	N/A	N/A	0.04	N/A	0.22	N/A
	Kuilima Drive	LOS	C	A	N/A	N/A	C	A	N/A	N/A	N/A	C	N/A	A	B
		Delay	26.7	7.0	N/A	N/A	20.9	3.8	N/A	N/A	N/A	21.6	N/A	4.8	14.0
		v/c	0.41	0.41	N/A	N/A	0.71	0.27	N/A	N/A	N/A	0.38	N/A	0.25	N/A
	Marconi Rd	LOS	C	B		C	B	A	A			B		A	B
		Delay	24.2	13.8		23.4	14.2	0.1	1.2			18.8		1.9	13.3
		v/c	0.24	0.64		0.18	0.67	0.06	0.16			0.21		0.15	N/A
	Joseph P. Leong Hwy	LOS	C	N/A	A	N/A	N/A	N/A	C	B	N/A	N/A	B	A	B
		Delay	29.0	N/A	0.1	N/A	N/A	N/A	31.5	12.0	N/A	N/A	16.8	3.5	14.9
		v/c	0.76	N/A	0.03	N/A	N/A	N/A	0.31	0.58	N/A	N/A	0.60	0.48	N/A
	Kahekili Hwy	LOS	N/A	N/A	N/A	F			N/A	N/A	N/A	B	N/A	N/A	B
		Delay	N/A	N/A	N/A	60.2			N/A	N/A	N/A	10.4	N/A	N/A	11.1
		v/c	N/A	N/A	N/A	0.92			N/A	N/A	N/A	0.12	N/A	N/A	N/A
2025 Weekend Peak Hour of Traffic With Resort Residential Alternative	Kaihalulu Drive	LOS	D	A	N/A	N/A	C	A	N/A	N/A	N/A	C	N/A	A	C
		Delay	44.0	8.5	N/A	N/A	33.4	0.7	N/A	N/A	N/A	33.4	N/A	8.2	22.2
		v/c	0.63	0.53	N/A	N/A	0.86	0.05	N/A	N/A	N/A	0.21	N/A	0.40	N/A
	Kuilima Drive	LOS	C	A	N/A	N/A	C	A	N/A	N/A	N/A	C	N/A	A	B
		Delay	34.8	9.2	N/A	N/A	25.9	3.4	N/A	N/A	N/A	28.3	N/A	6.8	17.8
		v/c	0.50	0.55	N/A	N/A	0.79	0.26	N/A	N/A	N/A	0.54	N/A	0.29	N/A
	Marconi Rd	LOS	C	B		C	C	A	A			C		A	B
		Delay	33.6	11.0		33.9	22.8	3.1	1.0			27.4		7.8	17.0
		v/c	0.49	0.62		0.20	0.79	0.15	0.13			0.37		0.31	N/A
	Joseph P. Leong Hwy	LOS	C	N/A	A	N/A	N/A	N/A	D	B	N/A	N/A	C	A	B
		Delay	31.9	N/A	0.7	N/A	N/A	N/A	48.2	16.3	N/A	N/A	26.5	5.3	19.8
		v/c	0.84	N/A	0.09	N/A	N/A	N/A	0.58	0.66	N/A	N/A	0.72	0.63	N/A
	Kahekili Hwy	LOS	N/A	N/A	N/A	F			N/A	N/A	N/A	B	N/A	N/A	C
		Delay	N/A	N/A	N/A	128.3			N/A	N/A	N/A	10.6	N/A	N/A	19.0
		v/c	N/A	N/A	N/A	1.11			N/A	N/A	N/A	0.14	N/A	N/A	N/A



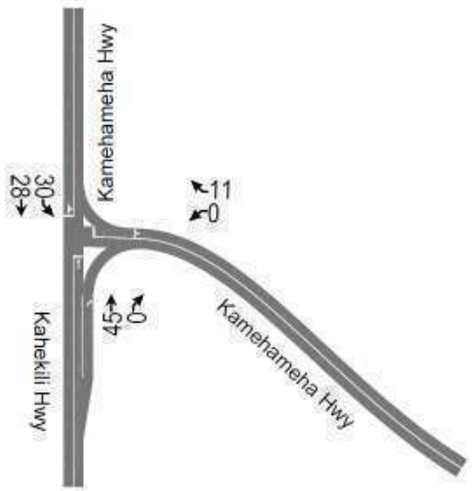
Legend

Lane Controls
137→ **Traffic Movement Volume (vph)**

Project Vicinity

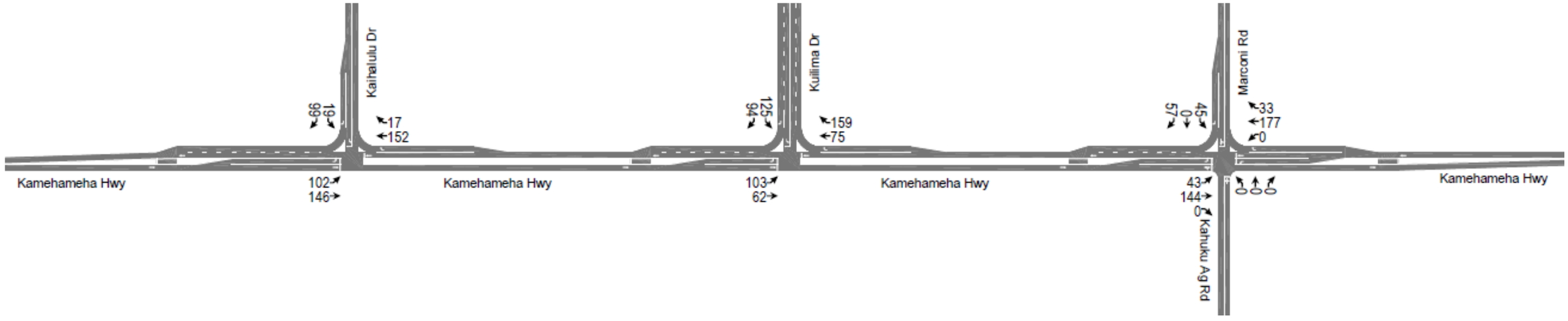


Haleiwa



Kahaluu

Figure 19. AM Peak Hour Site Traffic Assignment – Resort Residential Alternative

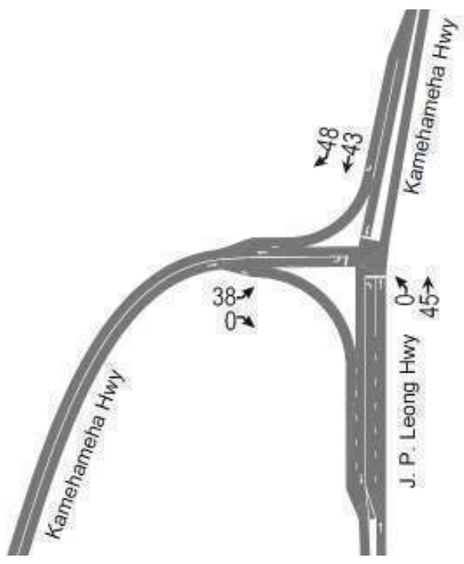


Project Vicinity

Legend

Lane Controls

137 **Traffic Movement Volume (vph)**



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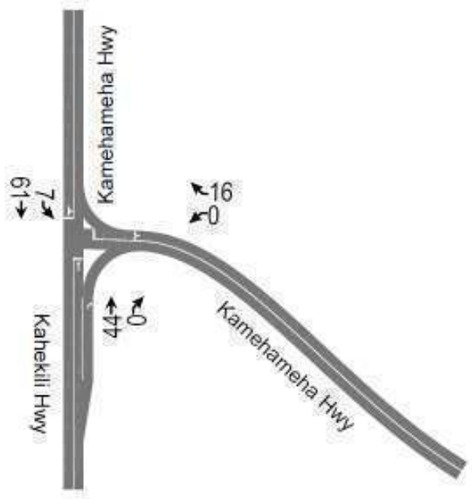
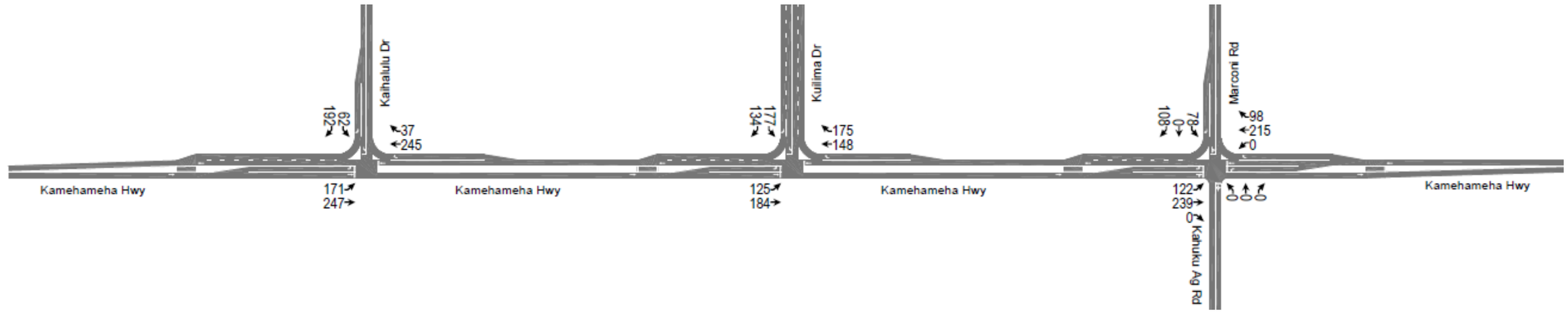


Kahaluu

Figure 20. PM Peak Hour Site Traffic Assignment – Resort Residential Alternative

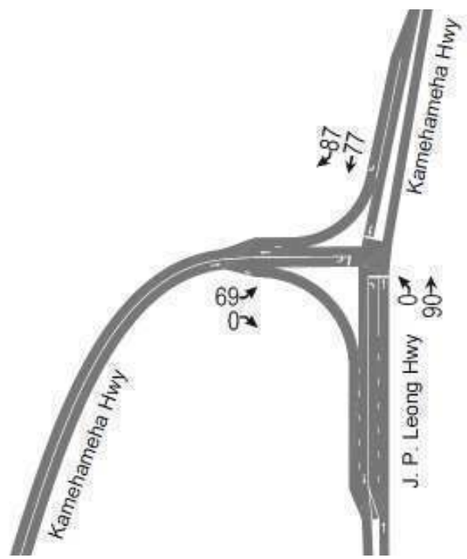


Project Vicinity

Legend

Lane Controls

137→ **Traffic Movement Volume (vph)**



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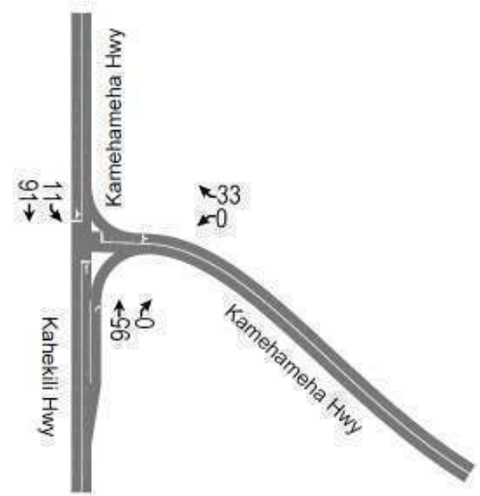
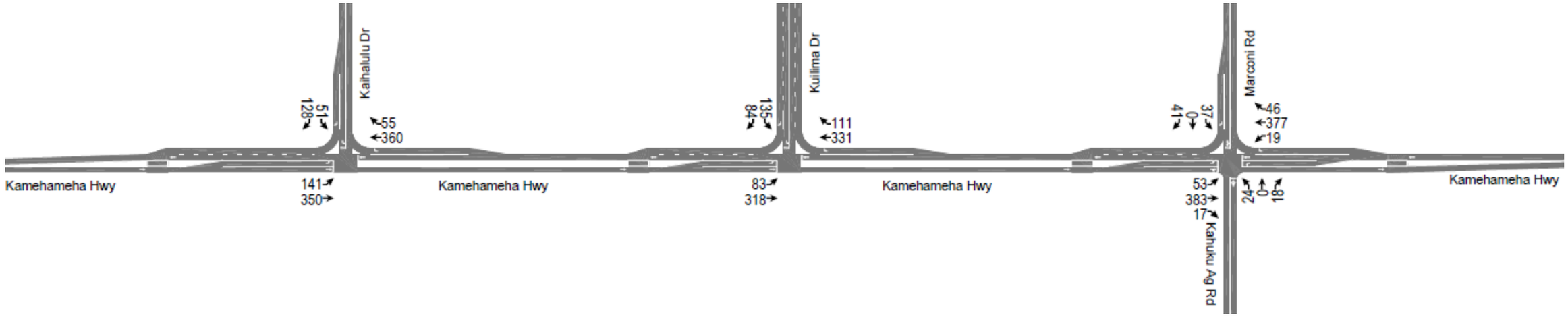


Kahaluu

Figure 21. Weekend Peak Hour Site Traffic Assignment – Resort Residential Alternative



Legend

Lane Controls
137 **Traffic Movement Volume (vph)**

Project Vicinity

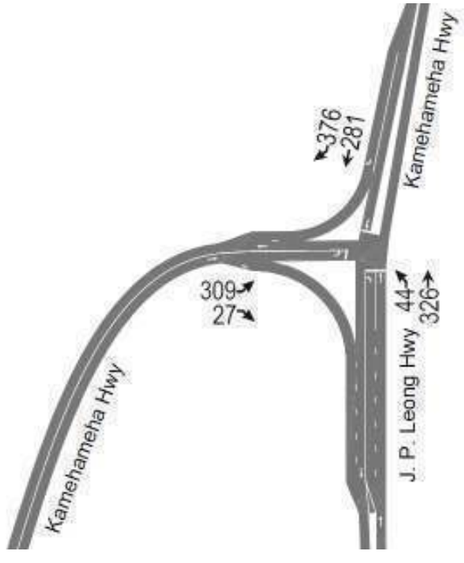


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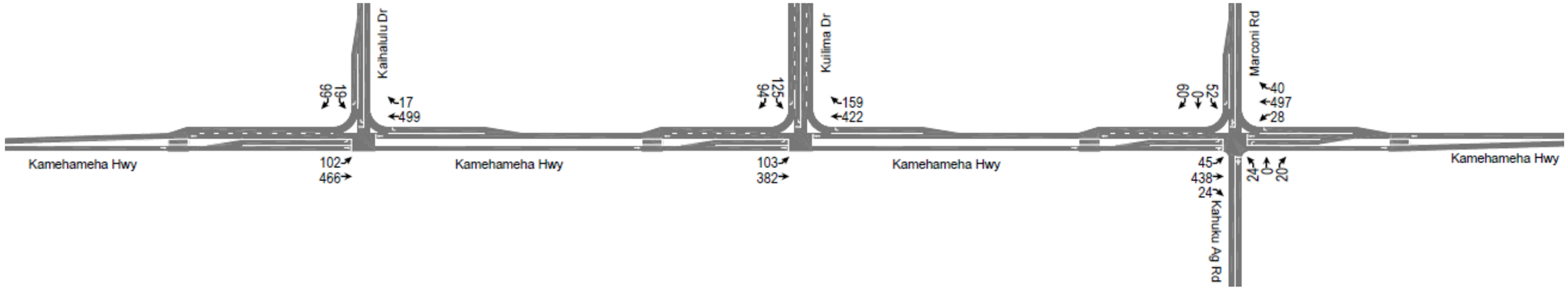
Figure 22. Cumulative AM Peak Hour Traffic – Resort Residential Alternative

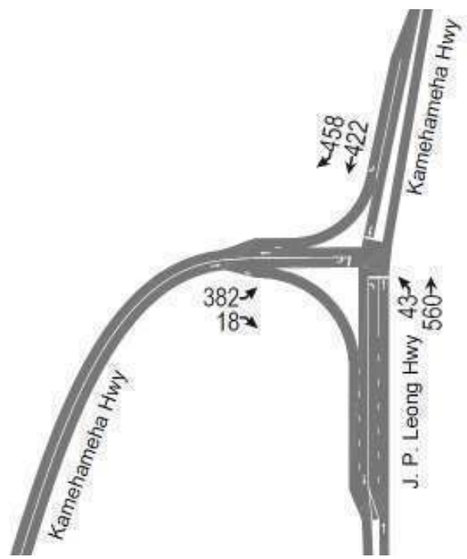


Project Vicinity

Legend

Lane Controls

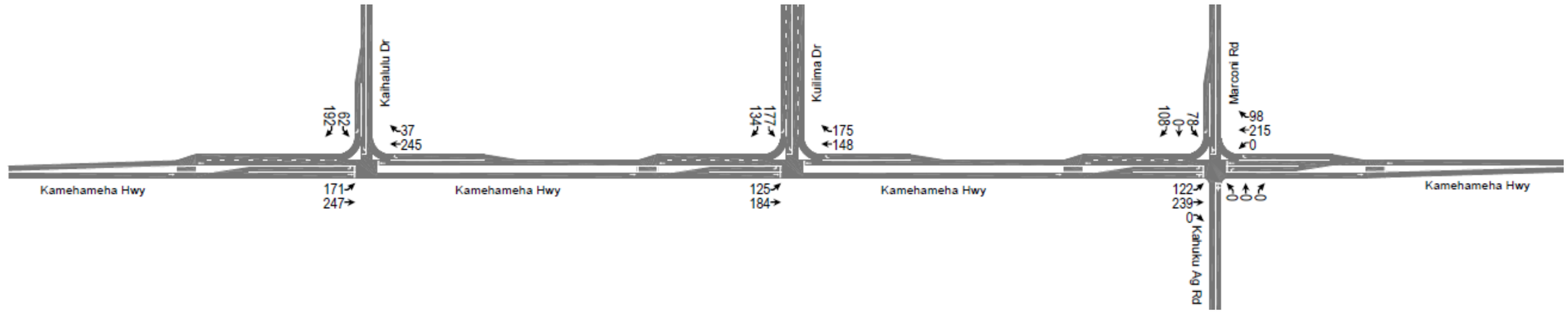
137→ **Traffic Movement Volume (vph)**



Haleiwa

Kahaluu

Figure 23. Cumulative PM Peak Hour Traffic – Resort Residential Alternative

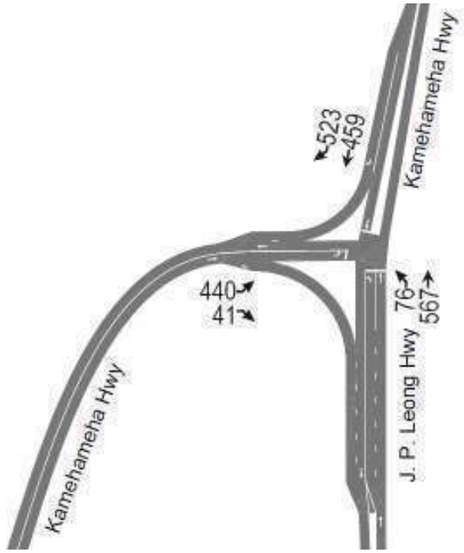


Project Vicinity

Legend

Lane Controls

137→ **Traffic Movement Volume (vph)**



Haleiwa

Kahaluu

Figure 24. Cumulative Weekend Peak Hour Traffic – Resort Residential Alternative

4. Conservation Partner Alternative

The Kamehameha Highway intersections at Kaihalulu Drive, Kuilima Drive, and Marconi Road are expected to operate at overall LOS "C" or better, during the peak hours of traffic with the Conservation Partner (CP) Alternative. The intersection of Kamehameha Highway and Joseph P. Leong Highway is expected to operate at LOS "C" or better, during the peak hours of traffic. The left-turn movement from westbound Kamehameha Highway to southbound Kahekili Highway is expected to operate at LOS "F" during the peak hours of traffic.

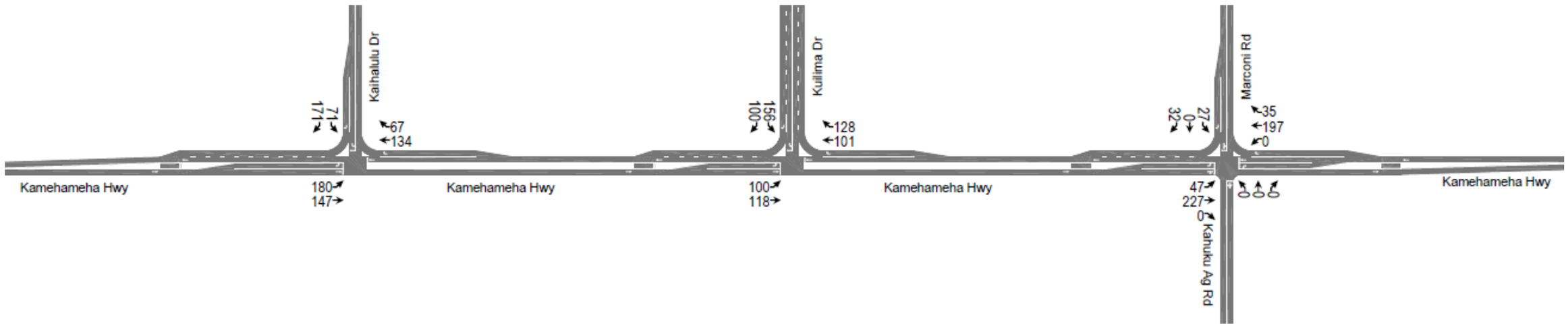
Table 16 summarizes the two-lane traffic analysis of Kamehameha Highway with the Conservation Partner Alternative. Table 17 summarizes the intersection analysis for the peak hours of traffic with the Conservation Partner Alternative. The AM, PM, and Weekend peak hour assignment of site traffic with the Conservation Alternative are depicted on Figures 25, 26, and 27, respectively. Figures 28, 29, and 30 depict the cumulative AM, PM, and Weekend peak hour traffic volumes, respectively, with the Conservation Partner Alternative.

Table 16. Peak Hour Two-Lane Operations on Kamehameha Highway With CP Alternative

Peak Hour	Location	LOS	v/c
Weekday AM	Haleiwa	E	0.46
	Kahuku	E	0.37
	Kahaluu	E	0.56
Weekday PM	Haleiwa	E	0.60
	Kahuku	E	0.44
	Kahaluu	E	0.65
Weekend	Haleiwa	E	0.70
	Kahuku	E	0.57
	Kahaluu	E	0.70

Table 17. Intersection Traffic Analysis Summary - 2025 Peak Hour Conditions With Conservation Partner Alternative

Scenario	Kamehameha Hwy Intersection	MOE	EBLT	EBTH	EBRT	WBLT	WBTH	WBRT	NBLT	NBTH	NBRT	SBLT	SBTH	SBRT	Intersection
2025 AM Peak Hour of Weekday Traffic With Conservation Partner Alternative	Kaihalulu Drive	LOS	C	A	N/A	N/A	C	A	N/A	N/A	N/A	C	N/A	A	B
		Delay	33.9	9.0	N/A	N/A	30.2	2.4	N/A	N/A	N/A	21.1	N/A	5.9	19.0
		v/c	0.62	0.42	N/A	N/A	0.76	0.14	N/A	N/A	N/A	0.17	N/A	0.34	N/A
	Kuilima Drive	LOS	C	A	N/A	N/A	C	A	N/A	N/A	N/A	C	N/A	A	B
		Delay	24.7	7.8	N/A	N/A	20.5	4.4	N/A	N/A	N/A	21.1	N/A	4.9	14.1
		v/c	0.37	0.41	N/A	N/A	0.64	0.25	N/A	N/A	N/A	0.43	N/A	0.25	N/A
	Marconi Rd	LOS	C	B		C	B	A	A			B		A	B
		Delay	20.4	10.3		22.7	12.6	0.2	1.2			17.7		0.4	11.0
		v/c	0.19	0.57		0.14	0.59	0.06	0.16			0.13		0.09	N/A
	Joseph P. Leong Hwy	LOS	C	N/A	A	N/A	N/A	N/A	C	B	N/A	N/A	B	A	B
		Delay	23.5	N/A	0.1	N/A	N/A	N/A	28.2	11.1	N/A	N/A	18.0	4.7	14.3
		v/c	0.70	N/A	0.05	N/A	N/A	N/A	0.33	0.42	N/A	N/A	0.44	0.51	N/A
	Kahekili Hwy	LOS	N/A	N/A	N/A	F			N/A	N/A	N/A	C	N/A	N/A	F
		Delay	N/A	N/A	N/A	>300			N/A	N/A	N/A	15.5	N/A	N/A	<300
		v/c	N/A	N/A	N/A	>1.2			N/A	N/A	N/A	0.66	N/A	N/A	N/A
2025 PM Peak Hour of Weekday Traffic With Conservation Partner Alternative	Kaihalulu Drive	LOS	D	A	N/A	N/A	C	A	N/A	N/A	N/A	C	N/A	A	C
		Delay	40.1	8.5	N/A	N/A	31.4	1.8	N/A	N/A	N/A	27.1	N/A	7.3	20.9
		v/c	0.61	0.45	N/A	N/A	0.82	0.09	N/A	N/A	N/A	0.11	N/A	0.34	N/A
	Kuilima Drive	LOS	C	A	N/A	N/A	C	A	N/A	N/A	N/A	C	N/A	A	B
		Delay	31.1	7.4	N/A	N/A	23.1	3.8	N/A	N/A	N/A	22.5	N/A	6.2	15.4
		v/c	0.49	0.42	N/A	N/A	0.74	0.31	N/A	N/A	N/A	0.44	N/A	0.29	N/A
	Marconi Rd	LOS	C	B		C	B	A	A			B		A	B
		Delay	24.1	13.1		26.1	15.9	0.1	1.3			19.2		1.5	13.9
		v/c	0.22	0.65		0.23	0.73	0.05	0.17			0.19		0.15	N/A
	Joseph P. Leong Hwy	LOS	C	N/A	A	N/A	N/A	N/A	C	B	N/A	N/A	B	A	B
		Delay	30.2	N/A	0.1	N/A	N/A	N/A	31.8	11.2	N/A	N/A	18.5	3.6	15.5
		v/c	0.78	N/A	0.03	N/A	N/A	N/A	0.31	0.51	N/A	N/A	0.65	0.51	N/A
	Kahekili Hwy	LOS	N/A	N/A	N/A	F			N/A	N/A	N/A	B	N/A	N/A	B
		Delay	N/A	N/A	N/A	71.7			N/A	N/A	N/A	10.5	N/A	N/A	13.1
		v/c	N/A	N/A	N/A	0.97			N/A	N/A	N/A	0.12	N/A	N/A	N/A
2025 Weekend Peak Hour of Traffic With Conservation Partner Alternative	Kaihalulu Drive	LOS	D	A	N/A	N/A	C	A	N/A	N/A	N/A	D	N/A	A	C
		Delay	50.4	8.1	N/A	N/A	34.9	2.9	N/A	N/A	N/A	35.4	N/A	8.4	23.4
		v/c	0.73	0.52	N/A	N/A	0.88	0.09	N/A	N/A	N/A	0.23	N/A	0.48	N/A
	Kuilima Drive	LOS	D	B	N/A	N/A	C	A	N/A	N/A	N/A	C	N/A	A	C
		Delay	46.3	10.0	N/A	N/A	32.9	3.4	N/A	N/A	N/A	26.5	N/A	6.0	20.7
		v/c	0.68	0.53	N/A	N/A	0.86	0.30	N/A	N/A	N/A	0.48	N/A	0.32	N/A
	Marconi Rd	LOS	C	B		C	C	A	A			C		A	B
		Delay	33.4	10.5		31.7	23.7	2.9	1.1			28.0		8.3	17.2
		v/c	0.48	0.61		0.16	0.81	0.14	0.13			0.34		0.31	N/A
	Joseph P. Leong Hwy	LOS	C	N/A	A	N/A	N/A	N/A	D	B	N/A	N/A	C	A	C
		Delay	34.4	N/A	0.7	N/A	N/A	N/A	49.1	17.7	N/A	N/A	28.8	5.5	21.3
		v/c	0.87	N/A	0.09	N/A	N/A	N/A	0.58	0.70	N/A	N/A	0.77	0.65	N/A
	Kahekili Hwy	LOS	N/A	N/A	N/A	F			N/A	N/A	N/A	B	N/A	N/A	F
		Delay	N/A	N/A	N/A	>300			N/A	N/A	N/A	11.8	N/A	N/A	89.7
		v/c	N/A	N/A	N/A	>1.2			N/A	N/A	N/A	0.19	N/A	N/A	N/A

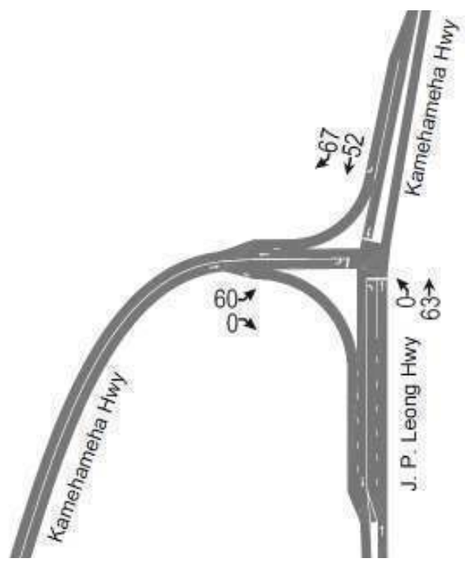


Project Vicinity

Legend

Lane Controls

137 **Traffic Movement Volume (vph)**



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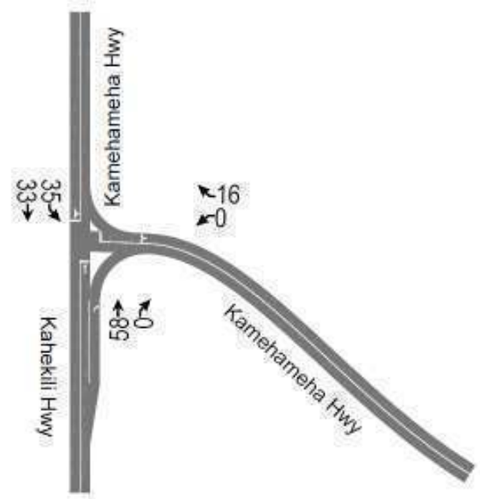
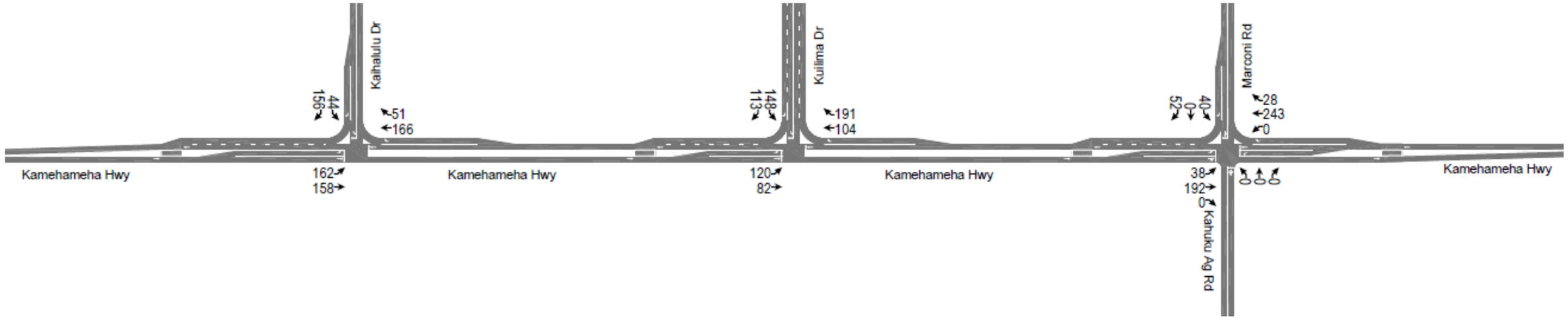


Kahaluu

Figure 25. AM Peak Hour Site Traffic Assignment – Conservation Partner Alternative

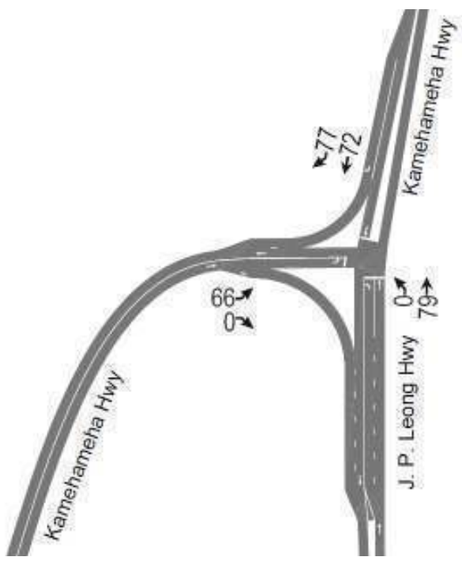


Project Vicinity

Legend

Lane Controls

137 **Traffic Movement Volume (vph)**



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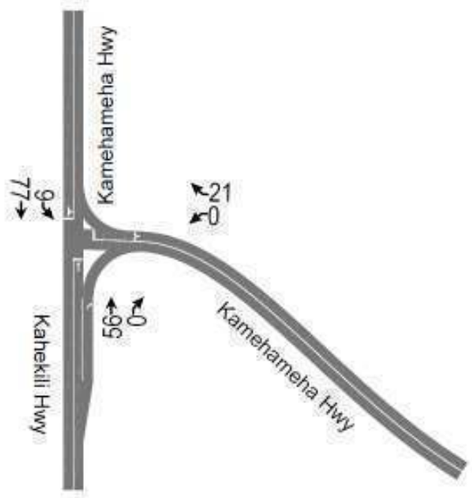
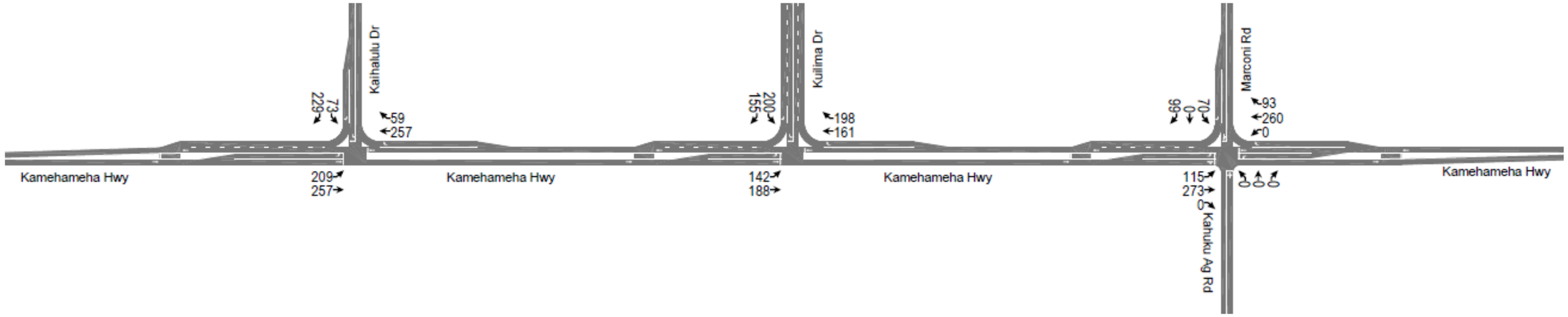


Kahaluu

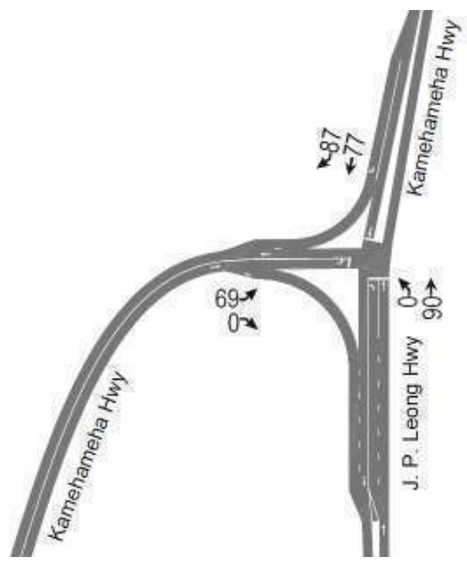
Figure 26. PM Peak Hour Site Traffic Assignment – Conservation Partner Alternative



Legend

Lane Controls
137→ **Traffic Movement Volume (vph)**

Project Vicinity



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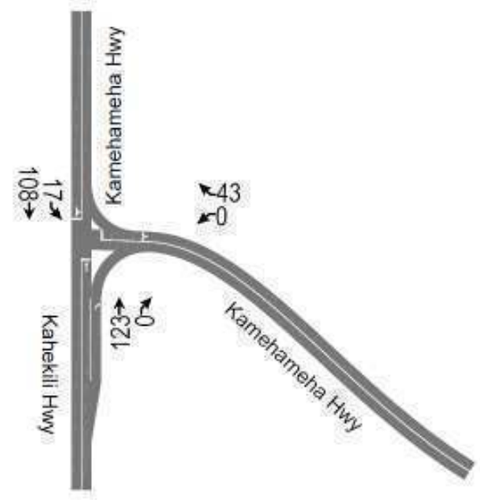


Kahaluu

Figure 27. Weekend Peak Hour Site Traffic Assignment – Conservation Partner Alternative

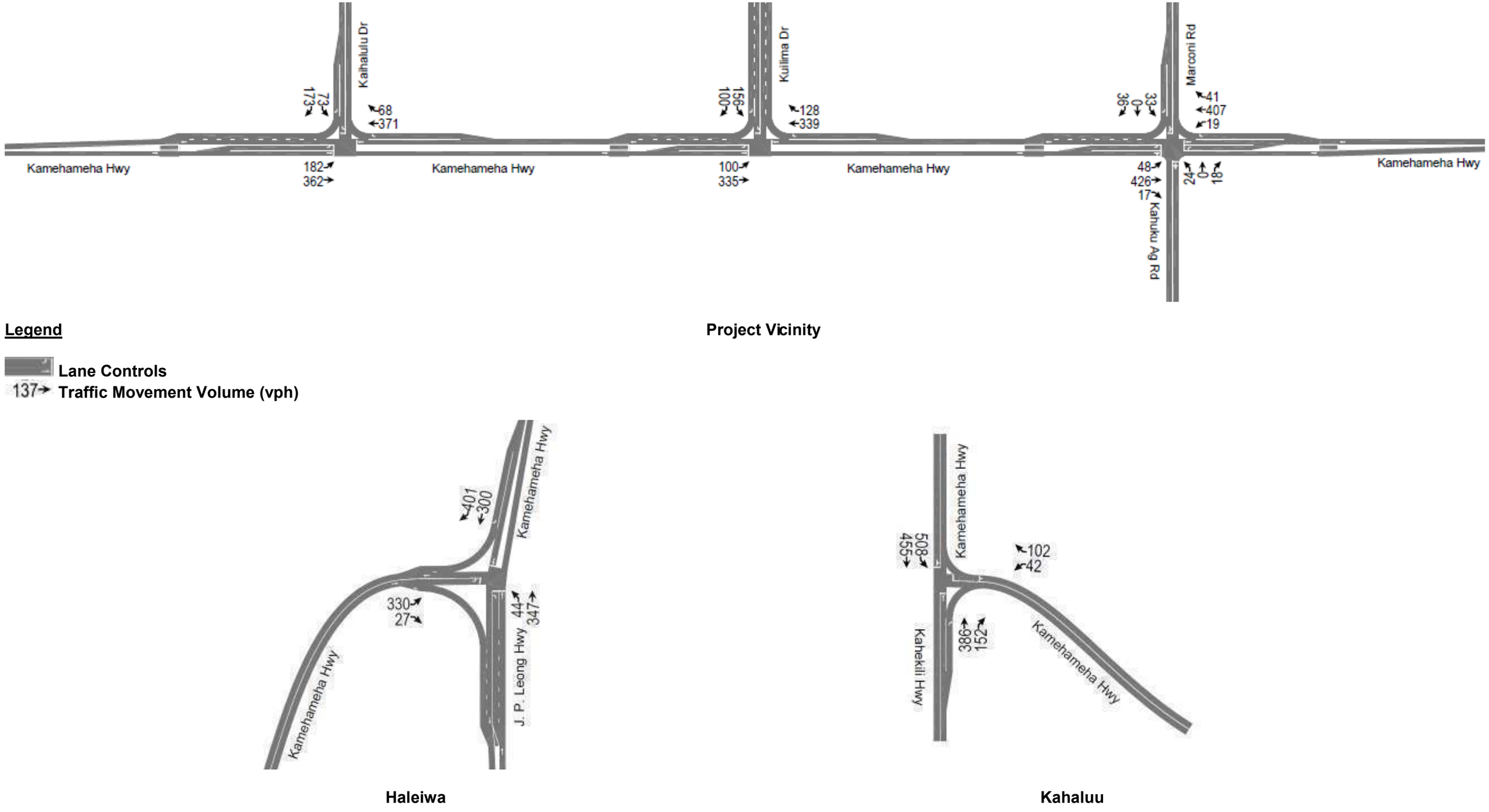
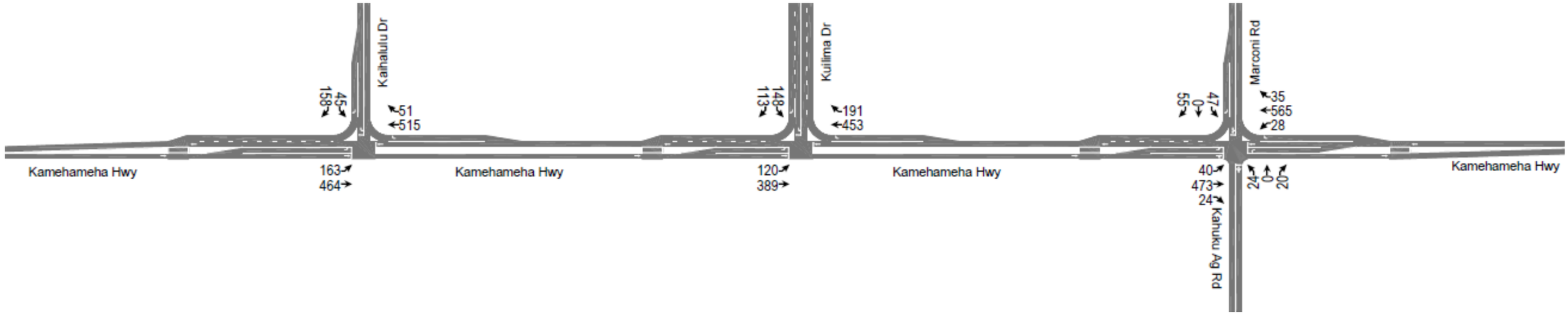


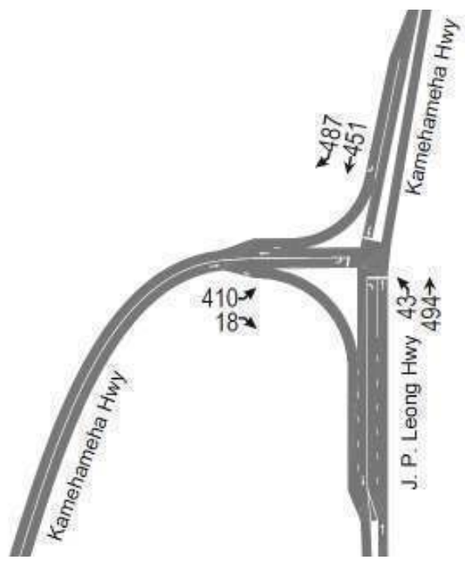
Figure 28. Cumulative AM Peak Hour Traffic – Conservation Partner Alternative



Legend

Lane Controls
137 **Traffic Movement Volume (vph)**

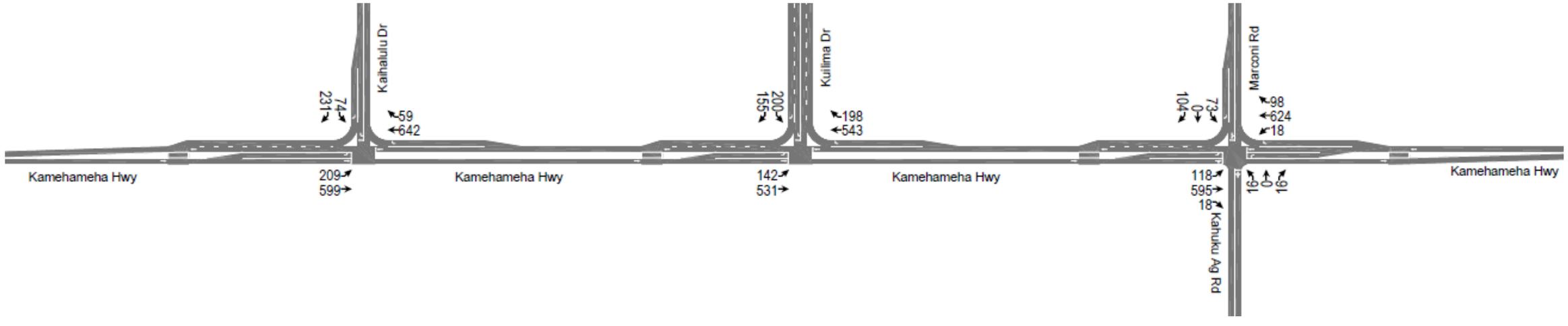
Project Vicinity



Haleiwa

Kahaluu

Figure 29. Cumulative PM Peak Hour Traffic – Conservation Partner Alternative

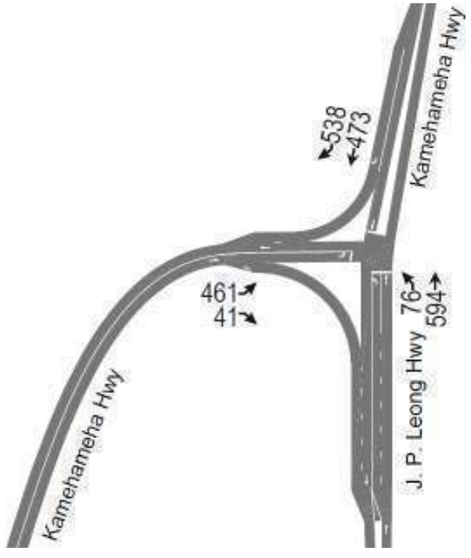


Legend

Lane Controls

137→ **Traffic Movement Volume (vph)**

Project Vicinity



Haleiwa

Kahaluu

Figure 30. Cumulative Weekend Peak Hour Traffic – Conservation Partner Alternative

C. Traffic Impact Analysis of the Proposed Action

1. Proposed Action Phasing

The purpose of analyzing the phasing of a long term development is to coordinate the proposed traffic improvements with the development schedule of the project. The development of the Proposed Action is expected to span eleven (11) years, from the Year 2015 through the Year 2025, which was based upon a market analysis prepared by HVS International Consulting and Evaluation.

In the first year of development, units on Parcels RR-1, RR-2a, RR-2b, H-1a, RR-5, RR-6, RES-1, and RES-2 are expected to begin occupancy. The first occupancy of Parcels RR-1, RR-2a, and RR-2b will require access on Kamehameha Highway at Kaihalulu Drive and the channelization improvements at the intersection. The initial development of Parcel H-1a will require the channelization improvements at the intersection of Kuilima Drive and Kamehameha Highway. Traffic signalization also will be necessary during the initial phase of development, since the intersection meets the MUTCD Warrant under existing conditions. When the first units are developed and become occupied, Parcels RR-5, RR-6, RES-1, and RES-2 will require the channelization improvements at the intersection of Marconi Road and Kamehameha Highway.

Because the Proposed Action is expected to start development on various Parcels across the entire Resort during the first year of occupancy, the previously discussed Kamehameha Highway channelization improvements at Kaihalulu Drive, Kuilima Drive, and Marconi Road are expected to be constructed in the first year of occupancy. Furthermore, Kaihalulu Drive also is expected to be constructed between Kamehameha Highway and Marconi Road during the first year of occupancy. This internal roadway would provide traffic circulation within the Resort, and minimize the Resort traffic demands on Kamehameha Highway.

The signalization of Kaihalulu Drive at Kamehameha Highway is <u>not</u> expected to be warranted until the final year of development. The traffic signals at Marconi Road and Kamehameha Highway are expected to become warranted when access to the Kahuku Mauka Agricultural Lots is constructed (by others) from Kamehameha Highway, opposite Marconi Road. As previously discussed, the Kahuku Mauka Agricultural Lots project is currently on hold. Since the traffic improvements for the Proposed Action are expected to be required only during the first year and the final year of development, the traffic impacts of the Proposed Action were analyzed at its completion.

The actual phasing of the development of the Proposed Action will be subject to future market and economic conditions. This traffic impact analysis report will be updated, as necessary, to coordinate the traffic improvements with any changes to the project schedule to the satisfaction of DOT and the City and County of Honolulu.

2. Year 2025 AM Peak Hour Traffic Analysis With the Proposed Action

The Kaihalulu Drive, Kuilima Drive, and Marconi Road intersections at Kamehameha Highway are expected to operate at LOS "B", during the Year 2025 AM peak hour of traffic with the Proposed Action. The individual traffic movements at all three intersections are expected to operate at LOS "C" or better. The AM peak hour site-generated traffic assignment for the Proposed Action is depicted on Figure 31. Figure 32 depicts the cumulative AM peak hour traffic with the Proposed Action.

3. Year 2025 PM Peak Hour Traffic Analysis With the Proposed Action

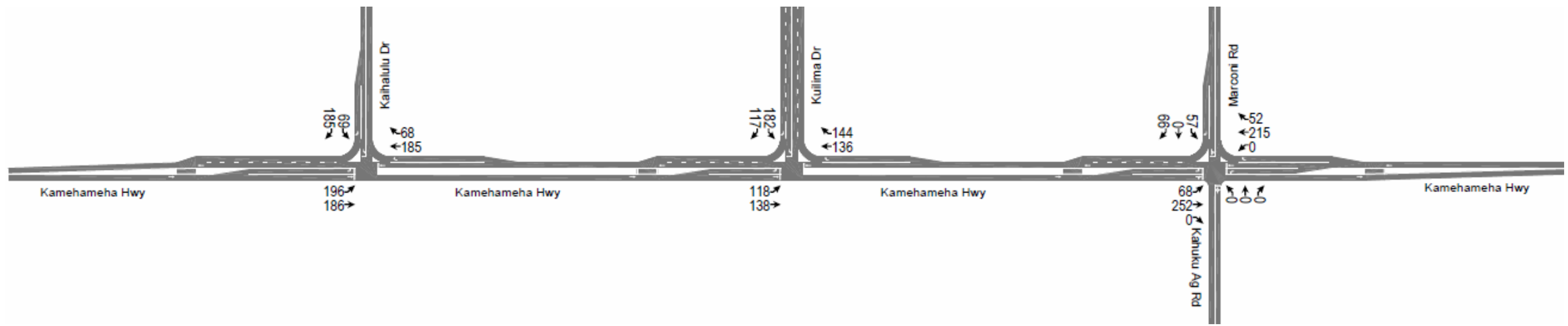
During the Year 2025 PM peak hour of traffic with the Proposed Action, the intersection of Kamehameha Highway and Kaihalulu Drive is expected to operate at LOS "C". The left-turn movement from eastbound Kamehameha Highway is expected to operate at LOS "D". The other traffic movements at the Kaihalulu Drive intersection are expected to operate at satisfactory Levels of Service.

The Kuilima Drive and Marconi Road intersections are expected to operate at overall LOS "B" at Kamehameha Highway, during the Year 2025 PM peak hour of traffic with the Proposed Action. The individual traffic movements at both intersections are expected to operate at satisfactory Levels of Service. Figure 33 depicts the PM peak hour site-generated traffic assignment for the Proposed Action. The cumulative PM peak hour traffic with the Proposed Action is depicted on Figure 34.

4. Year 2025 Weekend Peak Hour Traffic Analysis With the Proposed Action

The intersection of Kaihalulu Drive and Kamehameha Highway is expected to operate at an intersection LOS "C". The eastbound left-turn movement, westbound through movement, and the southbound left-turn movement are expected to operate at LOS "D".

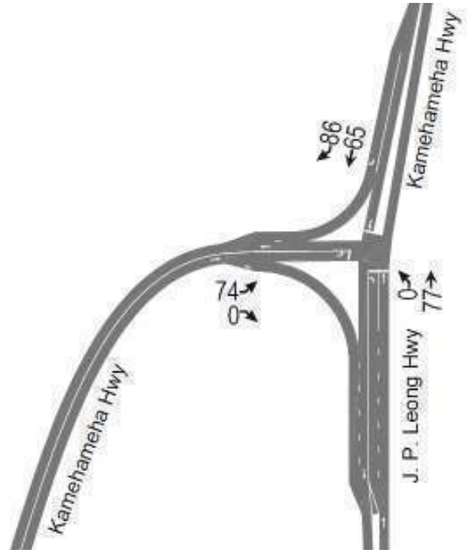
During the Year 2025 Weekend peak hour of traffic with the Proposed Action, the Kuilima Drive and Marconi Road intersections are expected to operate at an overall LOS "C" at Kamehameha Highway. The left-turn movements from Kamehameha Highway are expected to operate LOS "D". The other traffic movements at the intersections are expected to operate at satisfactory Levels of Service. Figure 35 depicts the Weekend peak hour site-generated traffic assignment for the Proposed Action. The cumulative Weekend peak hour traffic with the Proposed Action is depicted on Figure 36. Table 18 summarizes the intersection analysis for the peak hours of traffic with the Proposed Action.



Legend

Lane Controls
137 **Traffic Movement Volume (vph)**

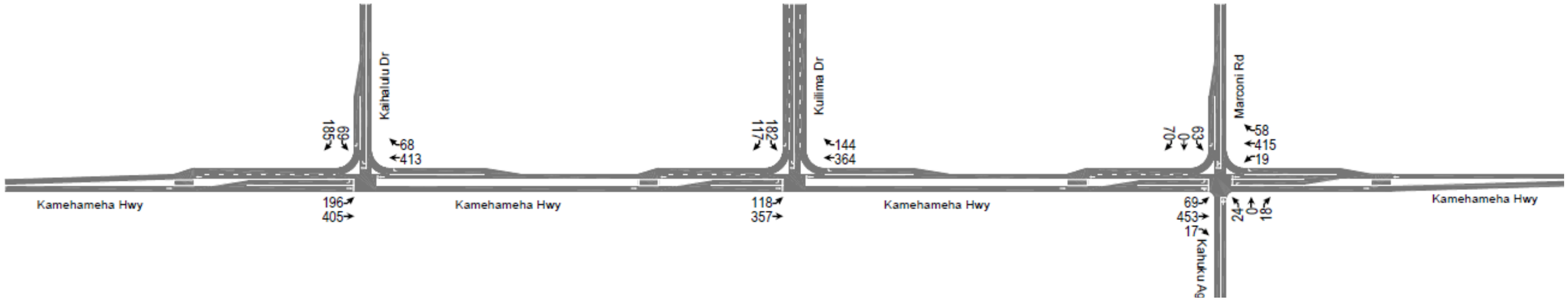
Project Vicinity



Haleiwa

Kahaluu

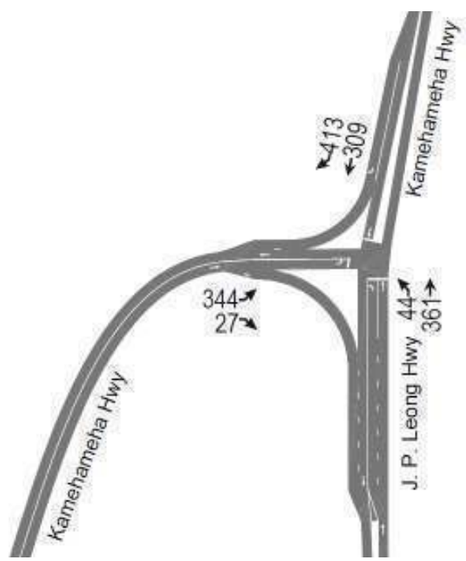
Figure 31. AM Peak Hour Site Traffic Assignment – Proposed Action



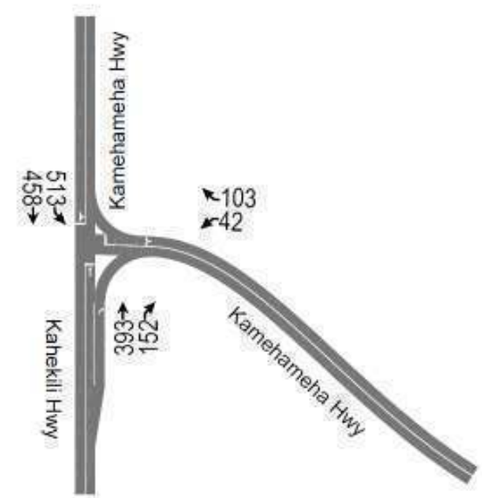
Legend

Lane Controls
137→ **Traffic Movement Volume (vph)**

Project Vicinity

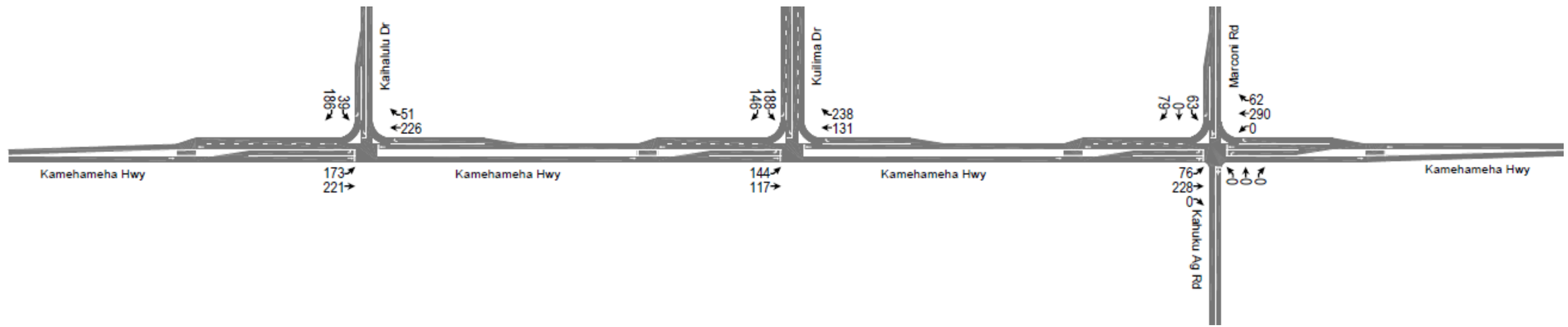


Haleiwa



Kahaluu

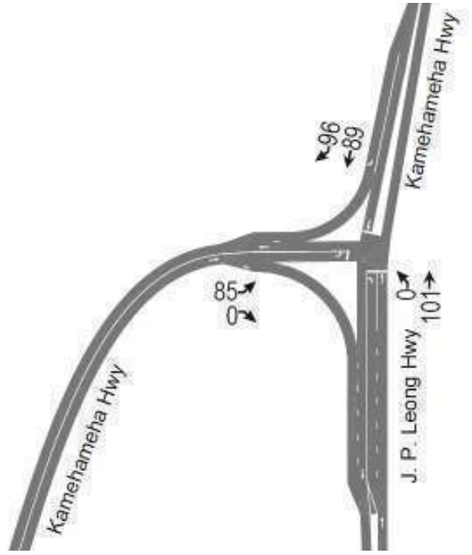
Figure 32. Cumulative AM Peak Hour Traffic – Proposed Action



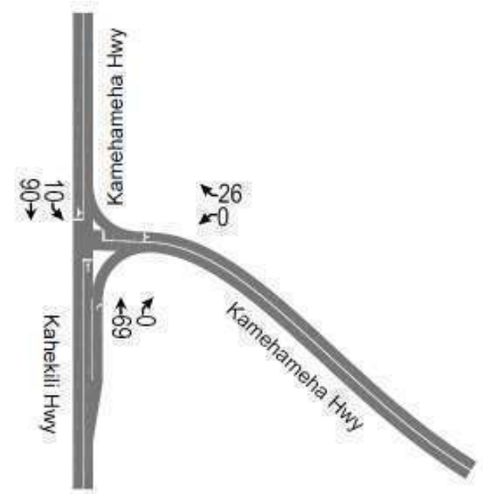
Legend

Lane Controls
137 **Traffic Movement Volume (vph)**

Project Vicinity

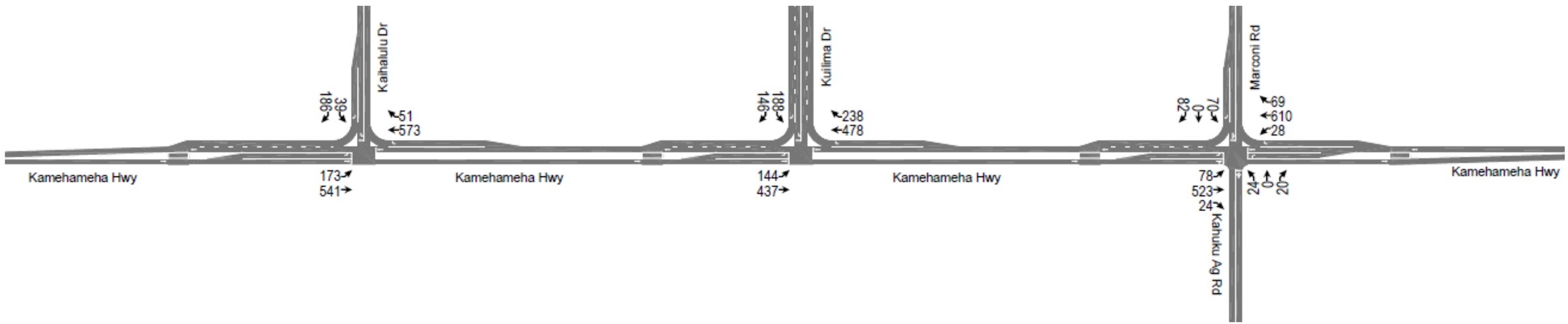


Haleiwa



Kahaluu

Figure 33. PM Peak Hour Site Traffic Assignment – Proposed Action

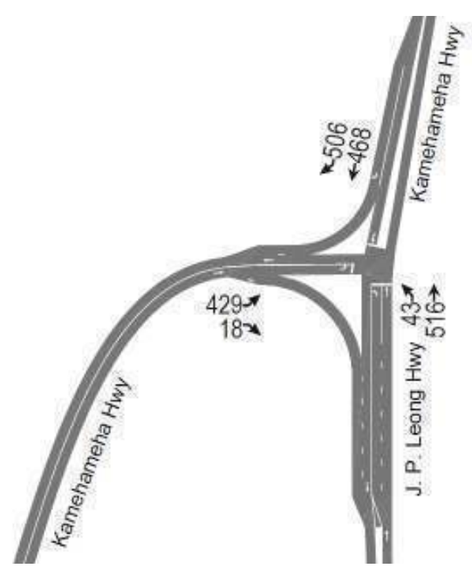


Legend

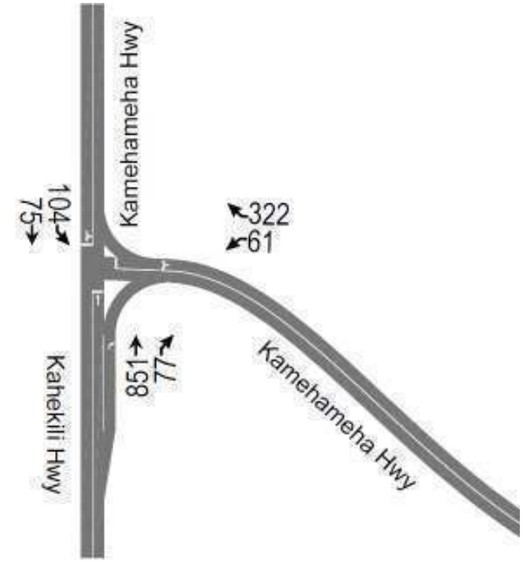
Lane Controls

137→ **Traffic Movement Volume (vph)**

Project Vicinity

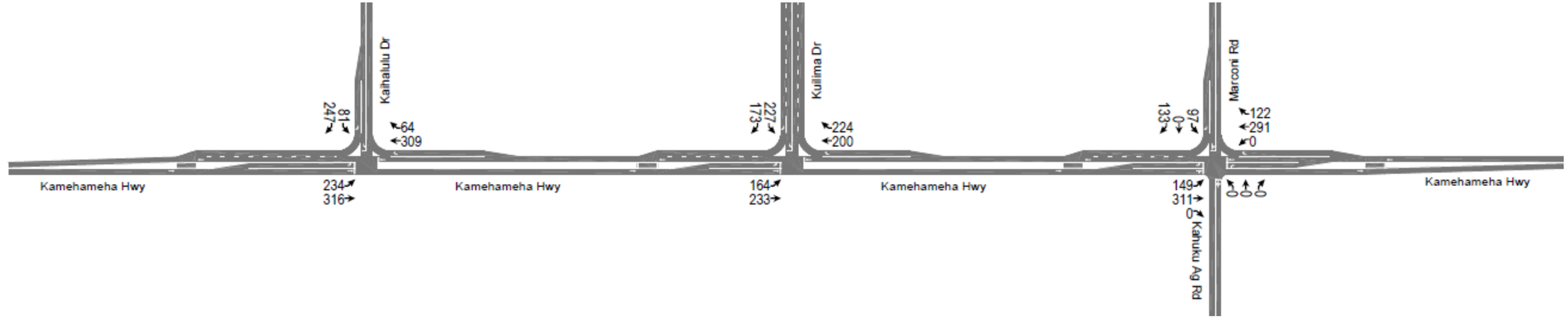


Haleiwa



Kahaluu

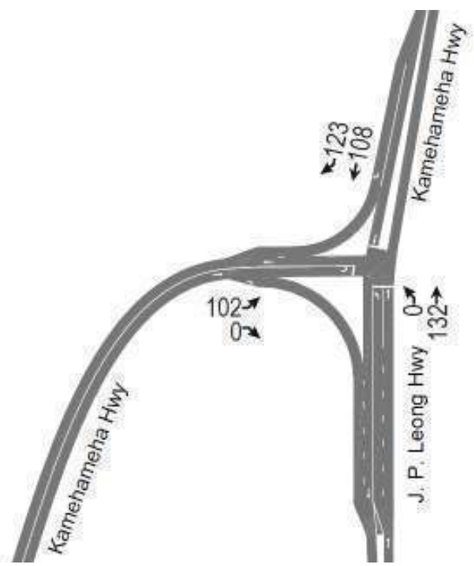
Figure 34. Cumulative PM Peak Hour Traffic – Proposed Action



Legend

Lane Controls
137 **Traffic Movement Volume (vph)**

Project Vicinity



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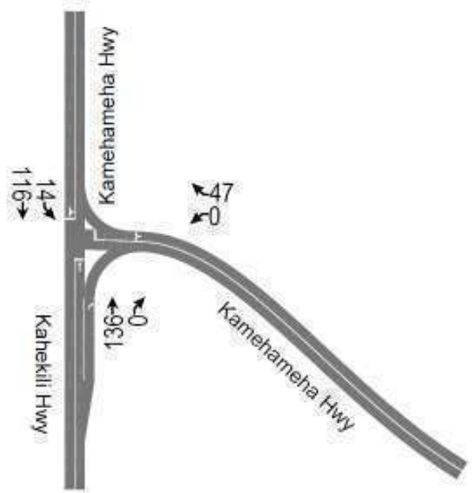
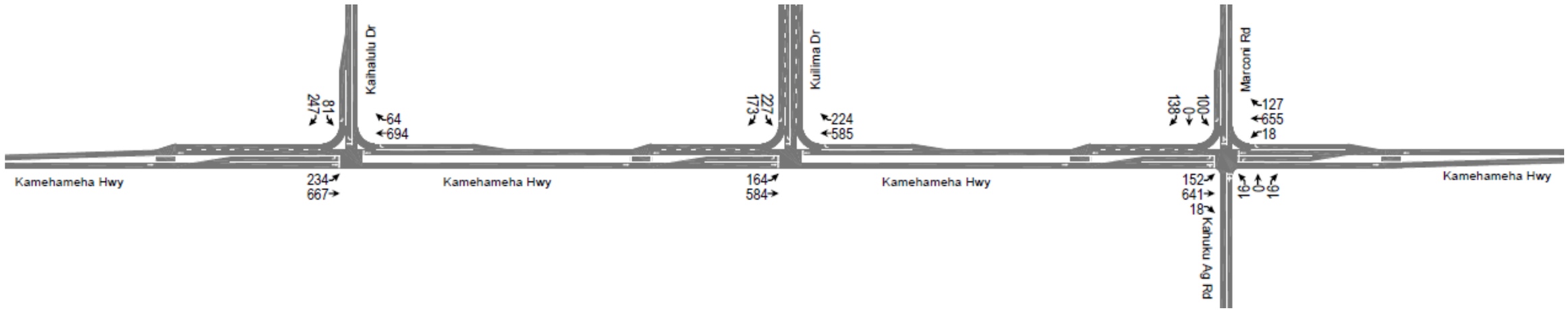


Kahaluu

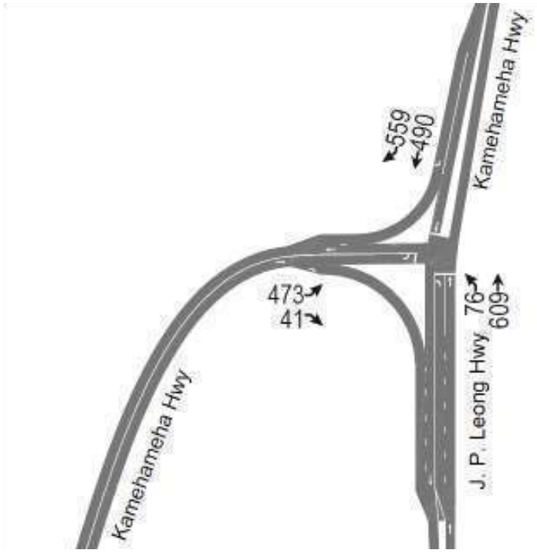
Figure 35. Weekend Peak Hour Site Traffic Assignment – Proposed Action



Legend

Lane Controls
137→ **Traffic Movement Volume (vph)**

Project Vicinity



Haleiwa

Kahaluu

Figure 36. Cumulative Weekend Peak Hour Traffic – Proposed Action

Table 18. Intersection Traffic Analysis Summary - 2025 Peak Hour Conditions With Proposed Action

Scenario	Kamehameha Hwy Intersection	MOE	EBLT	EBTH	EBRT	WBLT	WBTH	WBRT	NBLT	NBTH	NBRT	SBLT	SBTH	SBRT	Intersection
2025 AM Peak Hour of Weekday Traffic With Proposed Action	Kaihalulu Drive	LOS	C	A	N/A	N/A	C	A	N/A	N/A	N/A	C	N/A	A	B
		Delay	33.9	8.2	N/A	N/A	31.4	3.3	N/A	N/A	N/A	25.2	N/A	7.0	19.7
		v/c	0.62	0.43	N/A	N/A	0.79	0.13	N/A	N/A	N/A	0.18	N/A	0.39	N/A
	Kuilima Drive	LOS	C	A	N/A	N/A	C	A	N/A	N/A	N/A	C	N/A	A	B
		Delay	27.8	8.5	N/A	N/A	22.6	4.4	N/A	N/A	N/A	22.0	N/A	5.9	15.6
		v/c	0.44	0.44	N/A	N/A	0.69	0.27	N/A	N/A	N/A	0.48	N/A	0.28	N/A
	Marconi Rd	LOS	C	B		C	B	A	A			B		A	B
		Delay	24.4	11.8		25.3	15.5	0.7	1.2			19.5		2.7	13.0
		v/c	0.30	0.62		0.16	0.64	0.09	0.16			0.25		0.18	N/A
	Joseph P. Leong Hwy	LOS	C	N/A	A	N/A	N/A	N/A	C	B	N/A	N/A	B	A	B
		Delay	24.3	N/A	0.1	N/A	N/A	N/A	32.1	11.4	N/A	N/A	17.6	4.5	14.6
		v/c	0.72	N/A	0.05	N/A	N/A	N/A	0.39	0.43	N/A	N/A	0.44	0.51	N/A
	Kahekili Hwy	LOS	N/A	N/A	N/A	F			N/A	N/A	N/A	C	N/A	N/A	F
		Delay	N/A	N/A	N/A	>300			N/A	N/A	N/A	16.0	N/A	N/A	>300
		v/c	N/A	N/A	N/A	>1.2			N/A	N/A	N/A	0.68	N/A	N/A	N/A
2025 PM Peak Hour of Weekday Traffic With Proposed Action	Kaihalulu Drive	LOS	D	A	N/A	N/A	C	A	N/A	N/A	N/A	C	N/A	A	C
		Delay	44.8	9.0	N/A	N/A	32.9	1.7	N/A	N/A	N/A	28.4	N/A	7.4	21.8
		v/c	0.66	0.51	N/A	N/A	0.85	0.08	N/A	N/A	N/A	0.10	N/A	0.39	N/A
	Kuilima Drive	LOS	C	A	N/A	N/A	C	A	N/A	N/A	N/A	C	N/A	A	B
		Delay	34.0	7.9	N/A	N/A	24.1	3.7	N/A	N/A	N/A	28.0	N/A	6.9	16.6
		v/c	0.53	0.45	N/A	N/A	0.74	0.36	N/A	N/A	N/A	0.54	N/A	0.35	N/A
	Marconi Rd	LOS	C	B		C	C	A	A			C		A	B
		Delay	31.7	11.9		32.5	21.3	1.9	3.3			29.7		8.4	16.9
		v/c	0.33	0.59		0.20	0.79	0.10	0.20			0.33		0.26	N/A
	Joseph P. Leong Hwy	LOS	C	N/A	A	N/A	N/A	N/A	C	B	N/A	N/A	B	A	B
		Delay	31.2	N/A	0.1	N/A	N/A	N/A	32.0	11.8	N/A	N/A	19.6	3.7	16.3
		v/c	0.80	N/A	0.03	N/A	N/A	N/A	0.31	0.54	N/A	N/A	0.67	0.52	N/A
	Kahekili Hwy	LOS	N/A	N/A	N/A	F			N/A	N/A	N/A	B	N/A	N/A	C
		Delay	N/A	N/A	N/A	87.4			N/A	N/A	N/A	10.6	N/A	N/A	15.7
		v/c	N/A	N/A	N/A	1.02			N/A	N/A	N/A	0.13	N/A	N/A	N/A
2025 Weekend Peak Hour of Traffic With Proposed Action	Kaihalulu Drive	LOS	D	A	N/A	N/A	D	A	N/A	N/A	N/A	D	N/A	A	C
		Delay	53.5	7.9	N/A	N/A	38.1	3.9	N/A	N/A	N/A	41.3	N/A	9.4	25.2
		v/c	0.76	0.55	N/A	N/A	0.89	0.09	N/A	N/A	N/A	0.28	N/A	0.52	N/A
	Kuilima Drive	LOS	D	A	N/A	N/A	C	A	N/A	N/A	N/A	C	N/A	A	C
		Delay	48.7	9.4	N/A	N/A	33.1	3.4	N/A	N/A	N/A	32.7	N/A	6.7	21.5
		v/c	0.73	0.55	N/A	N/A	0.87	0.32	N/A	N/A	N/A	0.65	N/A	0.39	N/A
	Marconi Rd	LOS	D	B		D	C	A	A			C		A	C
		Delay	44.4	10.6		41.6	29.0	2.9	1.2			33.1		8.3	20.4
		v/c	0.66	0.60		0.26	0.87	0.17	0.14			0.48		0.38	N/A
	Joseph P. Leong Hwy	LOS	C	N/A	A	N/A	N/A	N/A	D	B	N/A	N/A	C	A	C
		Delay	33.5	N/A	1.2	N/A	N/A	N/A	47.0	13.2	N/A	N/A	32.0	5.7	21.6
		v/c	0.86	N/A	0.09	N/A	N/A	N/A	0.53	0.36	N/A	N/A	0.78	0.66	N/A
	Kahekili Hwy	LOS	N/A	N/A	N/A	F			N/A	N/A	N/A	B	N/A	N/A	F
		Delay	N/A	N/A	N/A	>300			N/A	N/A	N/A	11.9	N/A	N/A	95.3
		v/c	N/A	N/A	N/A	>1.2			N/A	N/A	N/A	0.19	N/A	N/A	N/A

5. Year 2025 Regional Traffic Analysis With the Proposed Action

Table 19 summarizes the regional traffic analysis of Kamehameha Highway with the Proposed Action.

Table 19. 2025 Peak Hour Two-Lane Operations on Kamehameha Highway With the Proposed Action

Peak Hour	Location	LOS	v/c
Weekday AM	Haleiwa	E	0.48
	Kahuku	E	0.41
	Kahaluu	E	0.57
Weekday PM	Haleiwa	E	0.63
	Kahuku	E	0.50
	Kahaluu	E	0.66
Weekend	Haleiwa	E	0.72
	Kahuku	E	0.63
	Kahaluu	E	0.71

VIII. Recommendations and Conclusions

A. Recommendations for the Proposed Action

1. Intersection Improvements

The following roadway improvements are recommended at each of the Kamehameha Highway intersections at Kaihalulu Drive, Kuilima Drive, and Marconi Road to accommodate the estimated increases in peak hour traffic with the development of the Proposed Action. The following access improvements are expected to mitigate the anticipated traffic impacts resulting from the implementation of the Proposed Action.

a. Westbound Kamehameha Highway should be widened to provide exclusive right-turn lanes at Kaihalulu Drive, Kuilima Drive, and Marconi Road.

b. Eastbound Kamehameha Highway should be widened to provide exclusive left-turn lanes at Kaihalulu Drive, Kuilima Drive, and Marconi Road.

c. Westbound Kamehameha Highway should be widened to provide right-turn acceleration lanes at Kaihalulu Drive, Kuilima Drive, and Marconi Road.

d. Each Resort access road should be widened/constructed to provide separate left-turn and right-turn lanes at Kamehameha Highway.

e. The Kamehameha Highway intersection at Kuilima Drive should be signalized, when improved to a channelized intersection.

f. The Kamehameha Highway intersection at Kaihalulu Drive should be signalized, when warranted.

g. The Kamehameha Highway intersection at Marconi Road should be signalized, when warranted.

2. Turning Lane Lengths

The left-turn storage lengths were based upon a protected left-turn signal phase at each of the Resort access intersections on Kamehameha Highway. The left-turn storage requirements were based upon the average of the 95th percentile queue lengths of ten (10) simulations, using SimTraffic. The acceleration and deceleration lengths are based upon AASHTO's A Policy on Geometric Design of Highways and Streets, (Exhibits 10-70 and 10-73) for the Kamehameha Highway design speed of 50 mph, as designated by DOT. The right-turn acceleration lane lengths are based upon an entrance curve design speed of 15 mph. The deceleration lane lengths are based upon a stop condition. Table 20 summarizes the turning lane requirements.

Table 20. Kamehameha Highway – Turning Lane Lengths (Feet)

Intersection	Lane		Storage Lane Length	Decel/ Accel Lane Length	Total	Design Lane Length
	Type	No.				
Kaihalulu Drive	EB LT	1	227	435	662	665
	WB RT Decel.	1	0	435	435	435
	WB RT Accel.	1	0	660	660	660
Kuilima Drive	EB LT	1	138	435	573	575
	WB RT Decel.	1	0	435	435	435
	WB RT Accel.	1	0	660	660	660
Marconi Road	EB LT	1	152	435	587	590
	WB RT Decel.	1	0	435	435	440
	WB RT Accel.	1	0	660	660	660
	WB LT	1	58	435	493	500

EB = eastbound WB = westbound LT = left-turn RT = right-turn
Decel = Deceleration Accel = Acceleration

3. Resort Roadways

As previously discussed, the development of the Proposed Action is expected to commence at various locations throughout the Resort area. Traffic improvements at each of the three access points on Kamehameha Highway should be constructed in the initial phase of development. Kaihalulu Drive also should be constructed in the first phase of development between Kamehameha Highway and Marconi Road. The two-lane internal road will facilitate traffic circulation within the Resort and reduce the traffic demand on Kamehameha Highway.

4. Traffic Demand Management

Turtle Bay Resort currently requires the implementation of an informal traffic demand management (TDM) plan by the promoters of special events held at the Resort. A TDM plan consists of a variety of mitigation measures, which are intended to reduce traffic generation. TDM measures are discussed in a memorandum titled "Turtle Bay Resort Transportation Demand Management (TDM) – Overview and Potential Strategies.", which was prepared by Fehr & Peers. TDM is a working document that will provide the Resort operator(s) a "toolbox", which will contain a variety of transportation strategies that can be implemented during special events as well as on a day-to-day basis. The effectiveness of each strategy will be measured during the implementation, which can be expected to reduce peak hour traffic from 5 percent to 15 percent. Since TDM measures cannot be accurately quantified at this writing, they were <u>not</u> taken into account in this traffic impact analysis.

5. Regional Traffic Improvements

The regional traffic improvements in the study area include the construction of turn lanes, guardrails, signage, and crosswalks to improve safety, as recommended in the ORTP. Kamehameha Highway is expected to remain a two-lane highway in response to community preference.

The intersection of Kamehameha Highway and Kahekili Highway in Kahaluu is an existing problem where the left-turn movement from westbound Kamehameha Highway to southbound Kahekili Highway is expected to continue to operate at LOS "F". The left-turn volumes on westbound Kamehameha Highway are below the minimum threshold volumes that are required to meet the warrants for the installation of traffic signals. The heavy left-turn demands on southbound Kamehameha Highway only occur during the existing 2-hour AM peak period, which would not meet traffic signal warrants. A modern roundabout intersection also has been considered by DOT. However, a multi-lane roundabout would be required to meet the traffic demands at the intersection. Currently, DOT restricts roundabout intersections on its highways to a single lane on the circular roadway. Finally, a left-turn refuge lane on Kahekili Highway would facilitate the left-turn movement from westbound Kamehameha Highway. However LOS "F" conditions would still persist during the existing AM peak hour of traffic.

B. Conclusions

The Proposed Action of the Turtle Bay Resort Master Plan is the first effort since the 1985 EIS to reduce the overall density of the Resort expansion. The owner/developer Turtle Bay Resort, LLC has reached out to the community and decision makers to craft a viable plan for the Turtle Bay Resort that addresses the concerns of the community. The Proposed Action represents a reduction of over 60 percent in the number of units that was originally proposed in the 1985 EIS through the 2009 Revised TIAR Update. Up to 40 percent of the weekend traffic is expected to be generated by resources that will be dedicated to the public, such as the beach parks, the farmers market, and the bird sanctuary and wildlife refuge.

This traffic study has consistently taken a conservative approach when establishing the assumptions upon which the traffic impact analysis is based. The ORTP travel forecast included an additional 300 resort units, which have not been credited in this study's forecast with the Proposed Action. The trip generation analysis has not taken into account the "critical mass" effect of a 2,243-unit resort, where trips are contained within the site by activities and opportunities of a destination resort.

The two-lane capacity of Kamehameha Highway is expected to accommodate the increase in traffic generated by the Proposed Action of the Turtle Bay Resort Master Plan. The LOS "E" conditions during the existing peak hours of traffic persist throughout the study area, and are expected to continue with or without the Proposed Action. The existing and future LOS "E" conditions, with or without the Proposed Action, are results of traffic flowing in platoons with few opportunities to pass slow-moving vehicles, resulting in restricted speeds, during the day and early evenings. The v/c ratios are less than 1.00 on Kamehameha Highway for all scenarios, which indicate available capacity on the two-lane highway.

Traffic congestion on the North Shore is a result of the uniqueness of the region, which attracts both visitors and residents alike. The "bottleneck" conditions on Kamehameha Highway at popular beach parks along the North Shore are results of motorists turning on and off Kamehameha Highway or parking on the Highway shoulders, and pedestrians walking across the Highway, thereby creating stop-and-go traffic flows. The land area for additional parking is limited on the makai side of Kamehameha Highway. The construction of parking lots on the mauka side of Kamehameha Highway will increase the pedestrian traffic across the Highway. A mauka bypass highway can increase the shoreline area to provide for more parking. However, a bypass highway would require the acquisition of additional rights-of-way. Additional parking will ultimately attract more traffic to the area. The current situation is further exacerbated by the world famous big wave surfing competitions during the winter months and the popular sightings of turtles sunning at Laniakea Beach, all of which contribute to the attractions on the North Shore of Oahu.

In Windward Oahu, traffic congestion occurs in the small towns along the coastline. The slow-moving traffic is typical of scenic routes as local traffic mixes with visitors touring the windward coast of Oahu. Left-turn storage lanes and refuge lanes will reduce delays at intersections. Bus bays also can reduce delays to through traffic. The existing congestion at the intersection of Kamehameha Highway and Kahekili Highway occur on the relatively low-volume left-turn movement from westbound Kamehameha Highway to Honolulu-bound Kahekili Highway. The existing conditions are somewhat mitigated by courteous drivers, who permit the left-turn movement onto Kahekili Highway, and the overall slow-moving traffic at the intersection. Several traffic mitigation measures have been considered. The construction of a left-turn storage lane and refuge lane can reduce delays, but not enough the improve the Level of Service. A single-lane roundabout intersection limits the capacity of the intersection. A multi-lane roundabout is currently not permitted on State highways. The existing traffic demands do not meet the volume warrants for the installation of traffic signals.

Up to 40 percent of the weekend traffic from the Proposed Action will be generated by benefits, which will be provided to the community by Turtle Bay Resort, such as, the beach parks, wildlife preserve, and the farmers market. While the farmers market traffic is not expected to extend beyond the study area, the beach parks and wildlife preserve could become regional attractions.

As the Turtle Bay Resort expands, Transportation Demand Management (TDM) measures are expected to be formalized into a plan which will be implemented by the Resort management. The remote location of the Resort, with only two routes to and from the Resort, present several opportunities for TDM measures, which can be implemented to promote alternative modes of transportation and reduce the Resort's contribution to traffic in the region.

Turtle Bay Resort LLC, and its consultants have worked extensively with the transportation agencies of the State of Hawaii and the City and County of Honolulu in the preparation of this traffic impact analysis. The traffic improvements, recommended herein, are expected to improve the capacity of Kamehameha Highway at the Turtle Bay Resort's access intersections, and mitigate the traffic impacts resulting from the development of the Proposed Action for the Turtle Bay Resort Master Plan.

TRAFFIC IMPACT ANALYSIS REPORT

FOR THE PROPOSED

TURTLE BAY RESORT MASTER PLAN

KAHUKU, OAHU, HAWAII

APPENDIX A

TRAFFIC COUNT DATA

Weekday Turning Movement Count Data
Study Name: Kam Hwy Kuilima Drive Wkday
Start Date: 11/03/2011

Vehicular Traffic

		Eastbound Kamehameha Hwy		Westbound Kamehameha Hwy		Southbound Kuilima Drive			
Start Time	End Time	Left-Turn	Through	Through	Right-Turn	Left-Turn	Right-Turn	Total	Hrly Total
6:00 AM	6:15 AM	7	20	21	10	12	5	75	
6:15 AM	6:30 AM	7	22	25	6	3	8	71	
6:30 AM	6:45 AM	10	40	26	7	4	5	92	
6:45 AM	7:00 AM	12	31	32	13	8	14	110	348
7:00 AM	7:15 AM	6	34	36	7	11	11	105	378
7:15 AM	7:30 AM	13	65	28	7	15	14	142	449
7:30 AM	7:45 AM	21	84	40	20	12	15	192	549
7:45 AM	8:00 AM	20	45	38	14	11	9	137	576
8:00 AM	8:15 AM	10	37	48	11	13	8	127	**598**
8:15 AM	8:30 AM	14	26	33	3	9	13	98	554
8:30 AM	8:45 AM	15	28	32	13	10	8	106	468
8:45 AM	9:00 AM	16	34	23	10	9	17	109	440
9:00 AM	9:15 AM	11	31	18	7	15	18	100	413
9:15 AM	9:30 AM	13	32	22	13	7	15	102	417
9:30 AM	9:45 AM	18	31	29	9	16	21	124	435
9:45 AM	10:00 AM	21	32	34	13	11	21	132	458
10:00 AM	10:15 AM	25	42	28	21	14	19	149	507
10:15 AM	10:30 AM	20	42	32	12	7	20	133	538
10:30 AM	10:45 AM	26	25	40	15	20	24	150	564
10:45 AM	11:00 AM	17	48	40	9	11	17	142	574
11:00 AM	11:15 AM	17	29	41	16	19	20	142	567
11:15 AM	11:30 AM	17	55	34	17	18	27	168	602
11:30 AM	11:45 AM	22	41	59	14	18	16	170	622
11:45 AM	12:00 PM	26	44	48	15	15	21	169	649
12:00 PM	12:15 PM	12	46	50	24	17	19	168	675
12:15 PM	12:30 PM	21	46	40	12	26	22	167	674
12:30 PM	12:45 PM	31	62	42	12	14	14	175	679
12:45 PM	1:00 PM	30	55	54	17	18	13	187	697
1:00 PM	1:15 PM	23	60	69	17	19	17	205	734
1:15 PM	1:30 PM	21	66	58	25	15	22	207	774
1:30 PM	1:45 PM	18	43	83	15	18	22	199	798
1:45 PM	2:00 PM	17	55	70	17	10	19	188	799
2:00 PM	2:15 PM	22	59	64	24	17	28	214	808
2:15 PM	2:30 PM	19	52	61	17	23	16	188	789
2:30 PM	2:45 PM	24	79	81	20	14	25	**243**	833
2:45 PM	3:00 PM	39	50	71	15	16	22	213	**858**
3:00 PM	3:15 PM	22	71	62	15	14	20	204	848
3:15 PM	3:30 PM	26	51	64	16	18	21	196	856
3:30 PM	3:45 PM	23	46	70	22	33	18	212	825
3:45 PM	4:00 PM	19	52	59	22	23	32	207	819
4:00 PM	4:15 PM	21	72	69	19	15	31	227	842
4:15 PM	4:30 PM	25	71	56	12	14	27	205	851
4:30 PM	4:45 PM	22	58	53	23	12	20	188	827
4:45 PM	5:00 PM	23	77	45	19	13	16	193	813
5:00 PM	5:15 PM	18	54	57	9	20	15	173	759
5:15 PM	5:30 PM	17	40	53	9	16	19	154	708
5:30 PM	5:45 PM	30	35	46	14	21	17	163	683
5:45 PM	6:00 PM	26	38	53	13	12	13	155	645

AM Peak Hour								
11:00 AM	12:00 PM	82	169	182	62	70	84	649
Peak Hour Factor		0.93	1.03	0.77	1.11	0.97	1.31	0.95
Heavy Vehicles (%)		3.7%	13.0%	5.5%	6.5%	5.7%	6.0%	7.4%
PM Peak Hour								
2:00 PM	3:00 PM	104	240	277	76	70	91	858
Peak Hour Factor		1.08	0.76	0.85	0.95	1.25	0.91	0.88
Heavy Vehicles (%)		1.9%	2.5%	5.4%	7.9%	4.3%	6.6%	4.4%

Saturday Turning Movement Count Data

Study Name Kam Hwy Kuilima Dr

Survey Date 11/5/2011 Saturday

Vehicular Traffic

		Eastbound Kamehameha Hwy		Westbound Kamehameha Hwy		Southbound Kuilima Drive			
Start Time	End Time	Left-Turn	Through	Through	Right-Turn	Left-Turn	Right-Turn	Total	Hrly Total
9:15 AM	9:30 AM	20	34	50	4	8	14	130	
9:30 AM	9:45 AM	18	35	40	11	16	27	147	
9:45 AM	10:00 AM	14	33	41	10	3	28	129	
10:00 AM	10:15 AM	23	32	42	9	9	17	132	538
10:15 AM	10:30 AM	26	36	72	18	16	31	199	607
10:30 AM	10:45 AM	18	32	52	12	17	35	166	626
10:45 AM	11:00 AM	19	43	64	23	13	21	183	680
11:00 AM	11:15 AM	23	49	75	12	15	36	210	758
11:15 AM	11:30 AM	22	60	68	18	22	26	216	775
11:30 AM	11:45 AM	18	51	60	13	14	24	180	789
11:45 AM	12:00 PM	19	63	88	19	18	21	228	834
12:00 PM	12:15 PM	27	81	68	18	10	21	225	849
12:15 PM	12:30 PM	28	62	81	18	21	27	237	870
12:30 PM	12:45 PM	32	78	78	14	18	31	251	941
12:45 PM	1:00 PM	33	49	77	23	27	26	235	948
1:00 PM	1:15 PM	35	69	72	21	22	31	250	973
1:15 PM	1:30 PM	21	81	89	16	16	30	253	989
1:30 PM	1:45 PM	24	70	77	20	16	22	229	967
1:45 PM	2:00 PM	25	79	68	22	17	26	237	969
2:00 PM	2:15 PM	24	95	76	27	14	26	262	981
2:15 PM	2:30 PM	26	78	87	21	28	32	272	1000
2:30 PM	2:45 PM	30	78	61	21	16	27	233	1004
2:45 PM	3:00 PM	37	77	98	26	16	19	**273**	**1040**
3:00 PM	3:15 PM	24	73	91	25	20	29	262	1040
3:15 PM	3:30 PM	32	67	70	15	26	18	228	996
3:30 PM	3:45 PM	30	83	58	16	17	30	234	997
3:45 PM	4:00 PM	25	71	63	16	17	36	228	952
4:00 PM	4:15 PM	20	65	59	18	23	43	228	918
4:15 PM	4:30 PM	24	77	51	13	25	35	225	915
4:30 PM	4:45 PM	30	62	56	22	13	26	209	890
4:45 PM	5:00 PM	28	75	78	16	16	15	228	890
5:00 PM	5:15 PM	20	75	48	11	15	27	196	858
5:15 PM	5:30 PM	28	60	52	16	14	28	198	831
5:30 PM	5:45 PM	24	66	46	8	17	17	178	800
5:45 PM	6:00 PM	23	49	49	18	16	28	183	755

Saturday Peak Hour Traffic

2:00 PM	3:00 PM	117	328	322	95	74	104	1040
Peak Hour Factor		0.79	1.06	0.82	0.91	1.16	1.37	0.95
Heavy Vehicles (%)		2.6%	1.5%	4.7%	4.2%	2.7%	1.9%	3.0%

Sunday Turning Movement Count Data
Study Name Kamehameha Hwy Kuilima Dr Sunday
Start Date 2/26/2012

Vehicular Traffic

		Eastbound Kamehameha Hwy		Westbound Kamehameha Hwy		Southbound Kuilima Drive			
Start Time	End Time	Left-Turn	Through	Through	Right-Turn	Left-Turn	Right-Turn	Total	Hrly Total
10:00 AM	10:15 AM	18	31	34	5	11	26	125	
10:15 AM	10:30 AM	15	44	37	3	7	31	137	
10:30 AM	10:45 AM	26	36	61	13	14	19	169	
10:45 AM	11:00 AM	39	57	62	21	12	40	231	662
11:00 AM	11:15 AM	31	58	49	12	8	22	180	717
11:15 AM	11:30 AM	16	47	58	14	20	34	189	769
11:30 AM	11:45 AM	27	55	82	11	11	29	215	815
11:45 AM	12:00 PM	20	35	57	15	22	25	174	758
12:00 PM	12:15 PM	23	76	73	16	12	30	230	808
12:15 PM	12:30 PM	25	69	61	22	12	30	219	838
12:30 PM	12:45 PM	16	64	64	18	10	22	194	817
12:45 PM	1:00 PM	20	69	88	6	9	21	213	856
1:00 PM	1:15 PM	21	56	98	13	14	31	233	859
1:15 PM	1:30 PM	22	73	80	29	11	27	242	882
1:30 PM	1:45 PM	35	79	103	18	19	20	**274**	962
1:45 PM	2:00 PM	29	88	81	20	13	27	258	1007
2:00 PM	2:15 PM	29	70	92	16	18	36	261	1035
2:15 PM	2:30 PM	20	73	91	19	17	23	243	**1036**
2:30 PM	2:45 PM	32	60	83	21	25	28	249	1011
2:45 PM	3:00 PM	33	77	83	16	15	36	260	1013
3:00 PM	3:15 PM	26	63	71	10	29	42	241	993
3:15 PM	3:30 PM	22	77	58	18	14	33	222	972
3:30 PM	3:45 PM	26	85	61	14	22	32	240	963
3:45 PM	4:00 PM	25	54	72	14	12	19	196	899
4:00 PM	4:15 PM	24	67	74	16	24	24	229	887
4:15 PM	4:30 PM	38	73	62	17	13	24	227	892
4:30 PM	4:45 PM	31	86	43	13	11	28	212	864
4:45 PM	5:00 PM	24	59	63	16	13	19	194	862
5:00 PM	5:15 PM	32	67	57	17	13	32	218	851
5:15 PM	5:30 PM	15	56	50	19	15	27	182	806
5:30 PM	5:45 PM	29	60	32	12	15	28	176	770
5:45 PM	6:00 PM	27	45	42	17	14	27	172	748

Sunday Peak Hour

1:30 PM	2:30 PM	113	310	367	73	67	106	1036
Peak Hour Factor		0.81	0.98	0.89	1.01	0.88	1.33	0.95
Heavy Vehicles (%)		1.8%	0.0%	0.0%	8.2%	3.0%	2.8%	0.2%

Weekday Turning Movement Count Data

Study Name Kam Hwy Marconi Rd Wkdy 0700-0830 1030-1630

Start Date 11/3/2011

Vehicular Traffic

		Eastbound Kamehameha Hwy		Westbound Kamehameha Hwy		Southbound Kuilima Drive			
Start Time	End Time	Left-Turn	Through	Through	Right-Turn	Left-Turn	Right-Turn	Total	Hrly Total
7:00 AM	7:15 AM	1	45	38	0	3	1	88	
7:15 AM	7:30 AM	1	74	37	1	1	0	114	
7:30 AM	7:45 AM	0	100	61	1	1	0	163	
7:45 AM	8:00 AM	2	56	57	2	2	0	119	484
8:00 AM	8:15 AM	1	52	55	1	0	0	109	505
8:15 AM	8:30 AM	0	34	33	2	1	0	70	461
10:30 AM	10:45 AM	1	48	51	1	0	2	103	
10:45 AM	11:00 AM	0	64	52	1	0	0	117	
11:00 AM	11:15 AM	0	40	51	3	1	1	96	
11:15 AM	11:30 AM	0	66	58	1	2	0	127	443
11:30 AM	11:45 AM	0	71	71	1	1	1	145	485
11:45 AM	12:00 PM	1	56	68	1	2	2	130	498
12:00 PM	12:15 PM	0	63	67	2	1	0	133	535
12:15 PM	12:30 PM	0	62	49	1	1	0	113	521
12:30 PM	12:45 PM	3	75	55	0	1	0	134	510
12:45 PM	1:00 PM	0	76	75	4	0	1	156	536
1:00 PM	1:15 PM	1	74	87	2	1	0	165	568
1:15 PM	1:30 PM	1	81	79	0	2	1	164	619
1:30 PM	1:45 PM	3	61	92	0	0	1	157	642
1:45 PM	2:00 PM	1	64	81	0	0	1	147	633
2:00 PM	2:15 PM	0	78	94	2	1	0	175	643
2:15 PM	2:30 PM	0	70	77	1	3	1	152	631
2:30 PM	2:45 PM	2	88	96	0	0	1	187	661
2:45 PM	3:00 PM	0	68	78	4	3	1	154	668
3:00 PM	3:15 PM	0	88	83	1	1	1	174	667
3:15 PM	3:30 PM	1	69	78	4	2	2	156	671
3:30 PM	3:45 PM	1	76	90	0	0	2	169	653
3:45 PM	4:00 PM	0	78	76	0	0	0	154	653
4:00 PM	4:15 PM	1	83	88	3	0	0	175	654
4:15 PM	4:30 PM	4	77	66	3	1	0	151	649

AM Peak Hour								
11:00 AM	12:00 PM	1	233	248	6	6	4	498
	PHF	N/A	0.82	0.87	1.50	1.50	1.00	0.86
PM Peak Hour								
2:00 PM	3:00 PM	2	304	345	7	7	3	668
	PHF	0.25	0.86	0.90	N/A	N/A	0.75	0.89

Saturday Turning Movement Count Data

Study Name Kam Hwy Marconi Rd Sat 1230-1530

Survey Date 11/5/2011

Vehicular Traffic

		Eastbound Kamehameha Hwy		Westbound Kamehameha Hwy		Southbound Kuilima Drive			
Start Time	End Time	Left-Turn	Through	Through	Right-Turn	Left-Turn	Right-Turn	Total	Hrly Total
12:30 PM	12:45 PM	0	86	100	4	2	1	193	
12:45 PM	1:00 PM	0	75	90	3	2	1	171	
1:00 PM	1:15 PM	1	94	101	1	1	1	199	
1:15 PM	1:30 PM	0	91	103	2	1	1	198	761
1:30 PM	1:45 PM	0	83	82	0	0	0	165	733
1:45 PM	2:00 PM	1	97	98	6	0	2	204	766
2:00 PM	2:15 PM	1	103	105	1	1	3	**214**	781
2:15 PM	2:30 PM	2	109	94	1	2	1	209	792
2:30 PM	2:45 PM	0	94	87	1	0	0	182	809
2:45 PM	3:00 PM	0	85	124	2	0	1	212	**817**
3:00 PM	3:15 PM	0	96	87	1	0	0	184	787
3:15 PM	3:30 PM	1	89	80	1	0	1	172	750

Saturday Peak Hour Traffic

2:00 PM	3:00 PM	3	391	410	5	3	5	817
Peak Hour Factor		0.75	0.95	0.98	1.25	0.75	0.42	0.95
Heavy Vehicles (%)		0.0%	2.0%	4.4%	0.0%	0.0%	0.0%	3.2%

Study Name Kamehameha Hwy Marconi Rd Sun 1300-1500

Survey Date 2/26/2012

Vehicular Traffic

		Eastbound Kamehameha Hwy		Westbound Kamehameha Hwy		Southbound Marconi Road			
Start Time	End Time	Left-Turn	Through	Through	Right-Turn	Left-Turn	Right-Turn	Total	Hrly Total
1:00 PM	1:15 PM	1	80	109	1	1	0	192	
1:15 PM	1:30 PM	0	79	98	2	1	0	180	
1:30 PM	1:45 PM	1	99	122	5	1	1	229	
1:45 PM	2:00 PM	2	95	112	1	2	1	213	814
2:00 PM	2:15 PM	0	82	91	2	0	0	175	797
2:15 PM	2:30 PM	0	94	113	2	1	1	211	828
2:30 PM	2:45 PM	0	86	107	1	1	0	195	794
2:45 PM	3:00 PM	1	86	89	2	0	0	178	759

Sunday Peak Hour

1:30 PM	2:30 PM	3	370	438	10	4	3	828
Peak Hour Factor		0.75	0.93	0.90	0.50	1.00	0.75	0.90

24-Hour Traffic Count Data on Kuilima Drive at Kamehameha Highway-Inbound
Site: [Kuilima Drive North] Kuilima Drive Hotel Entrance

* Sunday, October 30, 2011=928 (Incomplete) , 15 minute drops

	0:00	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00
Hrly	-	-	-	-	-	-	-	-	-	-	-	-	-	149	177	159	147	122	100	65	52	38	36	19
:00	-	-	-	-	-	-	-	-	-	-	-	-	-	39	43	41	35	33	34	21	17	11	11	6
:15	-	-	-	-	-	-	-	-	-	-	-	-	-	32	43	32	36	37	24	20	11	9	8	3
:30	-	-	-	-	-	-	-	-	-	-	-	-	-	38	47	42	42	27	20	11	11	10	10	5
:45	-	-	-	-	-	-	-	-	-	-	-	-	-	41	45	44	34	25	22	13	13	8	7	5

PM Peak Gen 14:45 to 15:45 Vol= 160 PHF= 0.89

* Monday, October 31, 2011=1665, 15 minute drops

	0:00	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	24-Hr
Hrly	9	3	3	6	29	42	54	114	93	108	103	129	151	116	159	142	144	117	110	75	76	82	40	16	1921
:00	3	0	1	0	2	7	9	18	24	30	26	34	41	25	35	52	31	29	24	21	23	15	9	4	
:15	1	2	2	1	5	11	13	28	22	19	19	44	28	18	41	27	37	31	21	20	11	35	12	5	
:30	1	0	0	2	5	10	14	36	25	30	27	26	50	33	43	30	43	23	39	20	27	10	11	5	
:45	4	2	0	3	17	15	18	33	23	30	32	26	33	40	40	34	34	34	26	15	15	23	8	2	

AM Peak Gen 10:45 to 11:45 Vol= 136 PHF= 0.77
PM Peak Gen 14:15 to 15:15 Vol= 176 PHF= 0.85

* Tuesday, November 01, 2011=1637, 15 minute drops

	0:00	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	24-Hr
Hrly	4	3	6	8	23	44	60	121	109	90	97	137	148	139	151	142	168	134	109	79	47	50	44	22	1935
:00	3	0	1	2	0	6	15	23	27	20	25	37	35	33	33	37	31	27	23	25	20	13	12	9	
:15	0	3	3	1	5	10	11	17	27	24	30	32	33	38	33	34	44	31	30	17	9	15	6	3	
:30	1	0	2	1	7	11	7	40	31	19	23	32	41	37	44	30	43	43	28	14	8	15	18	6	
:45	0	0	0	4	11	17	28	41	24	27	20	36	39	31	41	41	50	33	28	24	11	8	8	4	

AM Peak Gen 11:00 to 12:00 Vol= 137 PHF= 0.93
PM Peak Gen 16:00 to 17:00 Vol= 168 PHF= 0.84

* Wednesday, November 02, 2011=1661, 15 minute drops

	0:00	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	24-Hr
Hrly	8	3	2	5	27	45	65	104	112	94	113	108	131	162	160	133	160	116	96	78	63	70	39	14	1908
:00	2	2	0	0	4	8	14	14	26	23	27	23	24	45	35	29	49	24	26	24	11	10	10	0	
:15	4	1	1	1	1	9	15	21	34	20	26	27	32	44	41	33	18	40	30	19	23	20	11	4	
:30	2	0	1	1	8	9	9	34	22	22	31	33	33	31	38	34	40	20	19	14	18	28	13	6	
:45	0	0	0	3	14	19	27	35	31	29	29	26	42	43	46	38	53	32	22	21	11	12	5	4	

AM Peak Gen 10:00 to 11:00 Vol= 113 PHF= 0.91
PM Peak Gen 14:00 to 15:00 Vol= 160 PHF= 0.87

* Thursday, November 03, 2011=1952, 15 minute drops

	0:00	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	24-Hr
Hrly	3	5	5	6	25	46	74	107	98	117	150	158	166	157	186	169	163	137	135	100	88	73	46	22	2236
:00	1	2	1	1	1	7	18	13	21	20	45	40	33	43	48	37	38	23	34	25	30	13	8	13	
:15	0	1	1	2	3	12	12	19	19	32	37	34	41	42	37	42	38	31	45	32	22	32	11	4	
:30	1	0	2	1	4	12	15	39	30	30	39	39	45	39	45	46	42	44	23	24	22	19	18	2	
:45	1	2	1	2	17	15	29	36	28	35	29	45	47	34	57	44	46	40	34	19	14	9	10	3	

AM Peak Gen 11:00 to 12:00 Vol= 158 PHF= 0.88
PM Peak Gen 14:00 to 15:00 Vol= 186 PHF= 0.82

* Friday, November 04, 2011=2234, 15 minute drops

	0:00	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	24-Hr
Hrly	7	8	7	6	28	48	97	124	168	127	203	158	159	150	190	190	199	170	119	118	77	48	67	26	2494
:00	3	3	1	1	2	8	17	16	47	25	46	49	46	34	46	36	57	42	38	33	25	12	14	8	
:15	3	4	3	2	6	15	27	29	44	43	52	48	38	41	31	43	45	45	30	27	17	15	22	7	
:30	1	1	3	2	3	7	24	33	44	26	54	27	41	43	62	58	52	42	26	40	20	10	17	5	
:45	0	0	0	1	17	19	30	47	33	33	52	35	35	33	51	53	45	41	26	19	15	11	14	6	

AM Peak Gen 10:15 to 11:15 Vol= 207 PHF= 0.96
PM Peak Gen 15:30 to 16:30 Vol= 213 PHF= 0.92

* Saturday, November 05, 2011=2214, 15 minute drops

	0:00	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	24-Hr
Hrly	23	9	5	7	20	23	61	145	114	116	148	146	195	187	222	193	173	153	133	103	84	56	55	29	2400
:00	5	3	4	1	1	2	10	25	20	34	31	34	48	52	54	54	37	34	43	30	18	10	11	11	
:15	8	1	0	3	5	5	14	31	26	25	43	43	46	42	48	49	37	42	36	31	33	19	7	5	
:30	8	4	0	2	7	6	15	43	23	31	32	32	43	40	57	49	56	37	34	26	14	18	21	9	
:45	2	1	1	1	7	10	22	46	46	27	43	37	58	53	64	42	43	42	21	16	19	9	16	4	

AM Peak Gen 11:00 to 12:00 Vol= 146 PHF= 0.85
PM Peak Gen 14:15 to 15:15 Vol= 223 PHF= 0.87

* Sunday, November 06, 2011=1386, 15 minute drops

	0:00	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00
Hrly	3	9	6	7	22	32	53	110	132	142	121	169	187	215	222	-	-	-	-	-	-	-	-	-
:00	0	5	1	1	1	2	4	18	41	29	24	30	50	53	57	-	-	-	-	-	-	-	-	-
:15	1	1	3	2	3	8	11	27	33	31	28	51	44	48	46	-	-	-	-	-	-	-	-	-
:30	1	1	0	2	12	9	19	30	30	39	37	48	49	59	62	-	-	-	-	-	-	-	-	-
:45	1	2	2	2	6	13	19	36	28	44	33	40	44	55	57	-	-	-	-	-	-	-	-	-

AM Peak Gen 11:00 to 12:00 Vol= 169 PHF= 0.83

24-Hour Traffic Count Data on Kuilima Drive at Kamehameha Highway-Outbound
Site: Kuilima Drive at Kamehameha Hwy Entrance

* Sunday, October 30, 2011=928 (Incomplete) , 15 minute drops

	0:00	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00
Hrly	-	-	-	-	-	-	-	-	-	-	-	-	-	150	142	166	155	129	122	71	47	38	51	30
:00	-	-	-	-	-	-	-	-	-	-	-	-	-	33	41	51	48	36	32	23	15	15	21	18
:15	-	-	-	-	-	-	-	-	-	-	-	-	-	39	29	42	47	33	34	14	11	6	14	4
:30	-	-	-	-	-	-	-	-	-	-	-	-	-	40	35	46	34	40	31	20	10	7	11	4
:45	-	-	-	-	-	-	-	-	-	-	-	-	-	38	38	27	27	20	25	14	11	10	5	4

PM Peak Gen 14:45 to 15:45 Vol= 177 PHF= 0.87

* Monday, October 31, 2011=1665, 15 minute drops

	0:00	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	24-Hr
Hrly	10	4	1	3	14	23	59	105	94	130	137	119	149	125	149	144	155	134	107	58	39	55	35	26	1875
:00	7	2	0	0	1	7	11	27	27	28	31	37	43	27	45	37	48	45	41	22	9	10	8	6	
:15	0	1	1	0	4	2	18	30	24	30	28	32	47	28	37	35	40	29	22	18	15	18	12	8	
:30	1	0	0	1	5	3	14	26	17	34	32	28	30	41	33	37	32	26	29	10	10	17	9	6	
:45	2	1	0	2	4	11	17	23	26	38	47	23	30	29	35	35	35	34	15	8	5	10	6	6	

AM Peak Gen 10:45 to 11:45 Vol= 144 PHF= 0.77
PM Peak Gen 14:15 to 15:15 Vol= 142 PHF= 0.96

* Tuesday, November 01, 2011=1637, 15 minute drops

	0:00	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	24-Hr
Hrly	8	2	1	4	15	27	52	90	101	117	108	124	131	153	155	148	155	138	128	66	37	44	40	31	1875
:00	4	2	0	2	5	7	8	14	30	24	25	33	23	40	41	44	44	38	36	23	14	13	17	16	
:15	1	0	0	2	4	3	16	27	26	31	22	29	32	32	34	26	50	43	40	20	5	10	7	7	
:30	2	0	0	0	2	4	10	28	22	31	29	33	36	44	52	44	28	33	30	15	6	9	9	3	
:45	1	0	1	0	4	13	18	21	23	32	32	30	40	37	28	34	33	24	22	8	12	12	7	5	

AM Peak Gen 11:00 to 12:00 Vol= 124 PHF= 0.94
PM Peak Gen 16:00 to 17:00 Vol= 155 PHF= 0.78

* Wednesday, November 02, 2011=1661, 15 minute drops

	0:00	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	24-Hr
Hrly	11	2	1	1	14	34	54	110	80	89	136	134	122	145	151	145	161	123	114	62	59	57	31	30	1866
:00	4	1	0	0	4	11	13	17	18	23	35	34	33	27	33	37	58	25	34	14	19	13	14	17	
:15	3	1	1	0	2	7	14	29	18	17	26	36	37	35	35	31	36	37	37	21	11	16	6	4	
:30	2	0	0	0	3	5	10	38	24	25	35	35	25	41	42	39	35	33	23	12	21	15	10	6	
:45	2	0	0	1	5	11	17	26	20	24	41	29	29	42	41	38	32	28	20	15	8	13	1	3	

AM Peak Gen 10:00 to 11:00 Vol= 136 PHF= 0.83
PM Peak Gen 14:00 to 15:00 Vol= 151 PHF= 0.90

* Thursday, November 03, 2011=1952, 15 minute drops 1652

	0:00	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	24-Hr
Hrly	12	1	2	4	13	31	58	98	91	131	135	170	141	143	161	176	148	133	113	95	81	82	56	47	2122
:00	7	0	0	1	1	8	16	22	22	33	33	39	36	36	45	33	47	35	35	31	17	33	16	19	
:15	3	1	0	2	3	4	11	29	23	27	27	53	44	38	40	40	40	35	32	24	21	25	12	12	
:30	0	0	1	0	3	10	9	27	20	40	45	41	29	42	38	49	32	38	22	20	20	13	18	9	
:45	2	0	1	1	6	9	22	20	27	32	30	37	32	28	38	54	29	25	24	20	23	11	10	7	

AM Peak Gen 11:00 to 12:00 Vol= 170 PHF= 0.80
PM Peak Gen 14:00 to 15:00 Vol= 161 PHF= 0.89

* Friday, November 04, 2011=2234, 15 minute drops

	0:00	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	24-Hr
Hrly	19	6	5	3	14	21	56	93	108	125	143	149	162	153	153	168	171	166	165	95	92	96	95	115	2373
:00	10	1	1	0	0	7	16	26	36	30	33	33	32	26	45	38	47	49	54	33	24	30	10	57	
:15	4	4	3	1	3	3	11	19	21	30	42	44	36	40	33	37	58	43	48	23	20	26	24	24	
:30	2	1	1	0	6	5	14	24	26	35	32	34	52	51	35	48	35	41	30	21	25	21	22	23	
:45	3	0	0	2	5	6	15	24	25	30	36	38	42	36	40	45	31	33	33	18	23	19	39	11	

AM Peak Gen 10:15 to 11:15 Vol= 143 PHF= 0.85
PM Peak Gen 15:30 to 16:30 Vol= 198 PHF= 0.85

* Saturday, November 05, 2011=2214, 15 minute drops

	0:00	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	24-Hr
Hrly	25	10	2	5	13	14	40	76	118	139	161	179	182	182	179	196	196	162	160	67	64	62	107	49	2388
:00	11	5	1	2	2	4	6	19	34	40	28	53	31	53	40	49	66	42	46	16	26	22	22	23	
:15	7	2	0	0	4	1	7	16	28	24	47	48	47	47	61	46	59	41	29	17	19	18	30	12	
:30	1	1	0	2	5	3	13	25	27	45	53	40	50	38	43	48	39	35	44	16	9	11	34	9	
:45	6	2	1	1	2	6	15	16	29	31	33	39	54	44	35	53	32	44	41	18	10	11	21	5	

AM Peak Gen 11:00 to 12:00 Vol= 179 PHF= 0.84
PM Peak Gen 14:15 to 15:15 Vol= 188 PHF= 0.77

* Sunday, November 06, 2011=1386, 15 minute drops

	0:00	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00
Hrly	15	12	5	2	5	17	38	83	119	139	153	152	121	176	159	-	-	-	-	-	-	-	-	-
:00	8	6	1	0	3	1	5	15	23	35	28	46	31	36	31	-	-	-	-	-	-	-	-	-
:15	4	3	2	1	0	3	7	19	28	36	39	24	31	41	37	-	-	-	-	-	-	-	-	-
:30	1	0	1	1	2	5	10	24	34	31	49	36	27	57	46	-	-	-	-	-	-	-	-	-
:45	2	3	1	0	0	8	16	25	34	37	37	46	32	42	45	-	-	-	-	-	-	-	-	-

AM Peak Gen 11:00 to 12:00 Vol= 152 PHF= 0.83

24-Hour Traffic Count Data on Kuilima Drive at Kamehameha Highway
Site: Kuilima Drive at Kamehameha Hwy (Total for Both Directions)

* Sunday, October 30, 2011, 15 minute drops

	0:00	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00
Hrly	-	-	-	-	-	-	-	-	-	-	-	-	-	300	321	325	303	251	222	136	99	76	87	49
:00	-	-	-	-	-	-	-	-	-	-	-	-	-	72	84	**92**	83	69	66	44	32	26	32	24
:15	-	-	-	-	-	-	-	-	-	-	-	-	-	71	72	**74**	83	70	58	34	22	15	22	7
:30	-	-	-	-	-	-	-	-	-	-	-	-	-	78	82	**88**	76	67	51	31	21	17	21	9
:45	-	-	-	-	-	-	-	-	-	-	-	-	-	79	**83**	71	61	45	47	27	24	18	12	9

PM Peak Gen 14:45 to 15:45 Vol= 337

* Monday, October 31, 2011, 15 minute drops

	0:00	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	24-Hr
Hrly	19	8	4	9	43	66	114	221	188	239	242	250	302	241	309	287	300	251	217	134	115	138	75	42	3814
:00	10	2	1	0	3	14	20	45	51	58	57	**71**	84	52	80	**89**	79	74	65	43	32	25	17	10	
:15	1	3	3	1	9	13	31	58	46	49	47	**76**	75	46	**78**	62	77	60	43	38	26	53	24	13	
:30	2	0	0	3	10	13	28	62	42	64	59	**54**	80	74	**76**	67	75	49	68	30	37	27	20	11	
:45	6	3	0	5	21	26	35	56	49	68	**79**	49	63	69	**75**	69	69	68	41	23	20	33	14	8	

AM Peak Gen 10:45 to 11:45 Vol= 280
PM Peak Gen 14:15 to 15:15 Vol= 318

* Tuesday, November 01, 2011, 15 minute drops

	0:00	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	24-Hr
Hrly	12	5	7	12	38	71	113	211	210	208	206	262	279	292	306	290	323	272	237	146	85	95	84	53	3817
:00	7	2	1	4	5	13	23	37	57	44	50	**70**	58	73	74	81	**75**	65	59	48	34	26	29	25	
:15	1	3	3	3	9	13	27	44	53	55	52	**61**	65	70	67	60	**94**	74	70	37	14	25	13	10	
:30	3	0	2	1	9	15	17	68	53	50	52	**65**	77	81	96	74	**71**	76	58	29	14	24	27	9	
:45	1	0	1	4	15	30	46	62	47	59	52	**66**	79	68	69	75	**83**	57	50	32	23	20	15	9	

AM Peak Gen 11:00 to 12:00 Vol= 262
PM Peak Gen 16:00 to 17:00 Vol= 323

* Wednesday, November 02, 2011, 15 minute drops

	0:00	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	24-Hr
Hrly	19	5	3	6	41	79	119	214	193	183	250	243	255	308	311	279	321	239	211	140	122	127	70	44	3782
:00	6	3	0	0	8	19	27	31	44	46	**62**	57	57	72	**68**	66	107	49	60	38	30	23	24	17	
:15	7	2	2	1	3	16	29	50	52	37	**52**	63	69	79	**76**	64	54	77	67	40	34	36	17	8	
:30	4	0	1	1	11	14	19	72	46	47	**66**	68	58	72	**80**	73	75	53	42	26	39	43	23	12	
:45	2	0	0	4	19	30	44	61	51	53	**70**	55	71	85	**87**	76	85	60	42	36	19	25	6	7	

AM Peak Gen 10:00 to 11:00 Vol= 250
PM Peak Gen 14:00 to 15:00 Vol= 311

* Thursday, November 03, 2011, 15 minute drops

	0:00	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	24-Hr
Hrly	15	6	7	10	38	77	132	205	190	249	285	328	307	302	348	345	312	271	249	195	169	155	103	69	4367
:00	8	2	1	2	2	15	34	35	43	53	78	**79**	69	79	**93**	70	85	58	69	56	47	46	24	32	
:15	3	2	1	4	6	16	23	48	42	59	64	**87**	85	80	**77**	82	78	66	77	56	43	57	23	16	
:30	1	0	3	1	7	22	24	66	50	70	84	**80**	74	81	**83**	95	74	82	45	44	42	32	36	11	
:45	3	2	2	3	23	24	51	56	55	67	59	**82**	79	62	**95**	98	75	65	58	39	37	20	20	10	

AM Peak Gen 11:00 to 12:00 Vol= 328
PM Peak Gen 14:00 to 15:00 Vol= 348

* Friday, November 04, 2011, 15 minute drops

	0:00	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	24-Hr
Hrly	26	14	12	9	42	70	154	218	276	252	347	308	322	304	343	358	370	336	285	214	169	144	162	141	4876
:00	13	4	2	1	2	15	33	42	83	55	**79**	82	78	60	91	74	104	91	92	66	49	42	24	65	
:15	7	8	6	3	9	18	38	48	65	73	**94**	92	74	81	64	80	103	88	78	50	37	41	46	31	
:30	3	2	4	2	9	12	38	57	70	61	**86**	61	93	94	97	106	87	83	56	61	45	31	39	28	
:45	3	0	0	3	22	25	45	71	58	63	**88**	73	77	69	91	98	76	74	59	37	38	30	53	17	

AM Peak Gen 10:15 to 11:15 Vol= 350
PM Peak Gen 15:30 to 16:30 Vol= 411

* Saturday, November 05, 2011, 15 minute drops

	0:00	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	24-Hr
Hrly	48	19	7	12	33	37	102	221	233	257	310	326	377	369	402	390	369	317	294	170	148	118	162	78	4799
:00	16	8	5	3	3	6	16	44	54	74	59	**87**	79	105	94	103	103	76	89	46	44	32	33	34	
:15	15	3	0	3	9	6	21	47	54	49	90	**91**	93	89	109	95	96	83	65	48	52	37	37	17	
:30	9	5	0	4	12	9	28	68	50	76	85	**72**	93	78	100	97	95	72	78	42	23	29	55	18	
:45	8	3	2	2	9	16	37	62	75	58	76	**76**	112	97	99	95	75	86	62	34	29	20	37	9	

AM Peak Gen 11:00 to 12:00 Vol= 326
PM Peak Gen 14:15 to 15:15 Vol= 411

* Sunday, November 06, 2011, 15 minute drops

	0:00	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00
Hrly	18	21	11	9	27	49	91	194	251	282	275	321	308	391	381	-	-	-	-	-	-	-	-	-
:00	8	11	2	1	4	3	9	33	64	64	52	76	81	89	88		-	-	-	-	-	-	-	-
:15	5	4	5	3	3	11	18	46	61	67	67	75	75	89	83	-	-	-	-	-	-	-	-	-
:30	2	1	1	3	14	14	29	54	64	70	86	84	76	116	108	-	-	-	-	-	-	-	-	-
:45	3	5	3	2	6	21	35	61	62	81	70	86	76	97	102	-	-	-	-	-	-	-	-	-

AM Peak Gen 11:00 to 12:00 Vol= 321

24-Hour Traffic Count Data on Kuilima Drive at Kamehameha Highway-Inbound
Site: Kuilima Drive Hotel Entrance

* Sunday, October 30, 2011=928 (Incomplete) , 15 minute drops

	0:00	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00
Hrly	-	-	-	-	-	-	-	-	-	-	-	-	96	133	155	132	124	89	66	44	41	20	26	6
:00	-	-	-	-	-	-	-	-	-	-	-	-	2	29	38	35	27	25	25	16	16	9	12	1
:15	-	-	-	-	-	-	-	-	-	-	-	-	26	34	33	27	30	26	16	13	7	2	3	0
:30	-	-	-	-	-	-	-	-	-	-	-	-	37	36	42	33	40	19	16	10	9	6	6	2
:45	-	-	-	-	-	-	-	-	-	-	-	-	31	35	42	37	28	19	10	5	9	4	5	3

PM Peak 1400 - 1500 (155), PM PHF=0.92

* Monday, October 31, 2011=1665, 15 minute drops

	0:00	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	24-Hr
Hrly	4	2	2	6	32	40	52	112	102	114	108	136	140	119	130	127	100	83	57	51	51	66	26	11	1671
:00	0	0	1	0	1	8	9	17	26	35	30	31	35	30	27	46	20	19	11	15	15	4	7	4	
:15	1	0	1	0	4	11	14	25	20	19	24	44	28	17	35	27	29	16	15	15	8	35	7	4	
:30	0	0	0	3	6	8	12	38	26	35	24	36	38	34	35	24	27	20	18	10	16	9	7	1	
:45	3	2	0	3	21	14	18	33	31	26	30	25	40	38	34	30	25	29	13	12	12	18	6	2	

AM Peak 1045 - 1145 (140), AM PHF=0.80 PM Peak 1415 - 1515 (149), PM PHF=0.81

* Tuesday, November 01, 2011=1637, 15 minute drops

	0:00	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	24-Hr
Hrly	2	0	2	8	22	42	58	127	105	79	91	118	139	126	120	124	133	111	66	50	31	42	32	14	1642
:00	2	0	1	2	0	8	12	19	25	21	20	31	35	27	33	31	24	24	17	9	17	7	10	4	
:15	0	0	1	1	5	11	11	21	25	20	33	30	35	38	22	29	28	28	20	11	6	13	3	2	
:30	0	0	0	2	5	10	8	44	30	16	23	26	29	33	33	30	32	34	15	11	4	12	12	4	
:45	0	0	0	3	12	13	28	44	26	23	16	32	40	29	33	35	50	27	15	19	5	10	8	4	

AM Peak 0730 - 0830 (137), AM PHF=0.78 PM Peak 1200 - 1300 (139), PM PHF=0.87

* Wednesday, November 02, 2011=1661, 15 minute drops

	0:00	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	24-Hr
Hrly	9	1	1	5	29	44	61	101	105	91	118	101	115	144	149	125	124	95	69	53	37	46	34	9	1666
:00	0	1	0	0	4	9	9	10	24	22	29	19	24	40	27	22	41	25	13	16	8	4	9	0	
:15	3	0	1	1	2	8	16	26	32	21	32	20	27	38	41	35	15	31	26	14	12	18	10	3	
:30	6	0	0	2	9	10	10	30	24	20	30	38	27	27	38	32	28	13	13	10	10	16	8	4	
:45	0	0	0	3	15	17	28	36	26	28	28	24	38	39	44	36	41	26	18	14	8	8	8	2	

AM Peak 0730 - 0830 (121), AM PHF=0.85 PM Peak 1400 - 1500 (149), PM PHF=0.86

* Thursday, November 03, 2011=1952, 15 minute drops

	0:00	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	24-Hr
Hrly	3	2	5	5	27	48	71	114	93	112	138	147	144	134	167	155	135	107	103	80	68	53	33	13	1957
:00	2	2	0	0	1	6	13	14	21	21	44	46	26	40	36	32	34	18	24	21	22	12	9	6	
:15	0	0	1	2	4	12	11	21	21	28	36	31	38	37	31	40	29	26	36	21	19	21	4	3	
:30	1	0	0	1	4	12	16	41	22	27	31	34	43	27	41	41	39	37	21	22	19	16	13	1	
:45	0	0	4	2	19	18	32	38	29	36	27	37	38	30	59	42	34	27	22	17	9	5	8	3	

AM Peak 1100 - 1200 (147), AM PHF=0.80 PM Peak 1430 - 1530 (172), PM PHF=0.73

* Friday, November 04, 2011=2234, 15 minute drops

	0:00	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	24-Hr
Hrly	3	5	9	8	30	50	98	129	168	136	210	145	150	132	152	165	161	140	97	98	53	39	46	15	2239
:00	2	1	0	1	3	9	15	18	45	27	54	48	46	25	31	35	41	32	35	26	18	15	15	5	
:15	0	2	5	2	5	16	28	28	42	44	55	42	36	35	24	41	40	44	22	26	9	10	11	5	
:30	1	2	4	4	3	7	22	39	39	24	51	26	34	34	47	48	34	31	24	31	17	6	7	3	
:45	0	0	0	1	19	19	34	45	42	41	50	30	34	39	51	42	47	34	17	15	9	8	13	2	

AM Peak 1000 - 1100 (210), AM PHF=0.95 PM Peak 1445 - 1545 (174), PM PHF=0.86

* Saturday, November 05, 2011=2214, 15 minute drops

	0:00	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	24-Hr
Hrly	20	3	3	5	21	25	66	160	115	119	138	130	173	193	207	177	165	134	117	90	57	47	40	15	2220
:00	5	0	3	2	2	1	11	26	22	34	32	34	38	51	48	42	36	28	37	25	17	7	8	3	
:15	7	0	0	2	4	7	16	33	25	28	44	33	40	49	38	46	39	37	30	27	21	13	6	3	
:30	4	3	0	0	7	6	17	48	26	30	27	32	38	44	57	44	48	33	26	26	9	20	17	6	
:45	5	0	0	1	8	11	23	53	43	27	36	32	58	49	64	46	43	37	25	12	11	7	9	3	

AM Peak 0700 - 0800 (160), AM PHF=0.76 PM Peak 1430 - 1530 (208), PM PHF=0.81

* Sunday, November 06, 2011=1386, 15 minute drops

	0:00	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00
Hrly	4	4	4	5	21	29	56	119	131	133	111	152	175	209	223	-	-	-	-	-	-	-	-	-
:00	0	2	1	0	2	3	6	23	39	29	21	34	48	55	57	-	-	-	-	-	-	-	-	-
:15	1	1	0	1	3	8	11	26	31	26	22	46	42	44	49	-	-	-	-	-	-	-	-	-
:30	2	0	0	2	10	6	20	34	33	30	36	42	40	57	58	-	-	-	-	-	-	-	-	-
:45	1	1	3	2	7	12	19	38	29	49	33	31	45	53	60	-	-	-	-	-	-	-	-	-

AM Peak 1115 - 1215 (167), AM PHF=0.87 PM Peak 1400 - 1500 (223), PM PHF=0.93

24-Hour Traffic Count Data on Kuilima Drive at Kamehameha Highway-Outbound
Site: Kuilima Drive Hotel Entrance

* Sunday, October 30, 2011=1148 (Incomplete) , 15 minute drops

	0:00	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00
Hrly	-	-	-	-	-	-	-	-	-	-	-	-	-	141	133	157	144	123	114	67	43	37	49	26
:00	-	-	-	-	-	-	-	-	-	-	-	-	-	33	39	52	47	42	29	22	14	14	21	15
:15	-	-	-	-	-	-	-	-	-	-	-	-	-	32	27	47	40	33	33	12	8	7	13	4
:30	-	-	-	-	-	-	-	-	-	-	-	-	-	40	32	36	30	31	31	19	13	6	9	3
:45	-	-	-	-	-	-	-	-	-	-	-	-	-	36	36	22	28	18	21	14	9	11	6	4

PM Peak 1445 - 1545 (171), PM PHF=0.82

* Monday, October 31, 2011=1710, 15 minute drops

	0:00	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	24-Hr
Hrly	10	6	0	4	9	17	31	67	74	131	125	124	151	120	126	146	153	121	94	51	34	62	34	25	1715
:00	8	2	0	0	0	6	5	20	26	31	30	33	43	30	44	33	48	42	36	17	5	12	8	8	
:15	1	2	0	0	2	1	11	18	10	30	28	34	43	25	30	39	36	25	21	15	14	20	11	9	
:30	0	0	0	2	4	1	8	11	12	37	25	29	36	40	26	38	31	26	28	14	11	20	10	4	
:45	1	2	0	2	3	9	8	19	26	33	43	29	30	26	27	37	39	28	10	6	5	10	6	5	

AM Peak 1145 - 1245 (149), AM PHF=0.88 PM Peak 1515 - 1615 (161), PM PHF=0.85

* Tuesday, November 01, 2011=1715, 15 minute drops

	0:00	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	24-Hr
Hrly	9	1	2	3	15	16	27	58	90	105	94	126	121	140	151	144	142	134	125	73	34	46	37	28	1721
:00	4	1	0	2	5	5	3	14	26	26	21	29	20	26	43	43	49	42	38	28	11	10	18	15	
:15	2	0	0	1	5	2	6	13	23	23	23	31	30	29	36	27	44	38	41	17	5	13	4	7	
:30	2	0	0	0	3	0	5	16	22	29	27	36	43	45	44	40	27	27	30	20	4	9	5	4	
:45	1	0	2	0	2	9	13	16	21	28	24	30	29	41	29	35	23	27	16	9	15	15	10	2	

AM Peak 1100 - 1200 (126), AM PHF=0.87 PM Peak 1530 - 1630 (167), PM PHF=0.86

* Wednesday, November 02, 2011=2196, 15 minute drops

	0:00	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	24-Hr
Hrly	12	1	0	0	12	23	34	69	70	77	131	124	108	156	155	145	170	204	231	118	111	118	62	70	2201
:00	5	0	0	0	4	10	7	13	16	21	34	37	26	27	39	34	62	46	83	25	38	19	28	43	
:15	3	1	0	0	3	5	8	22	16	14	28	33	28	35	38	31	35	70	67	39	20	30	13	13	
:30	4	0	0	0	4	2	8	18	20	23	37	28	28	48	34	41	30	49	42	20	44	40	17	11	
:45	1	0	0	0	2	7	11	16	18	20	32	27	27	47	45	40	44	40	39	35	10	29	4	4	

AM Peak 1030 - 1130 (139), AM PHF=0.94 PM Peak 1715 - 1815 (241), PM PHF=0.73

* Thursday, November 03, 2011=1828, 15 minute drops

	0:00	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	24-Hr
Hrly	25	3	7	6	20	47	46	65	75	90	97	127	118	121	134	151	136	119	97	92	75	84	54	45	1834
:00	17	0	0	4	0	16	16	16	21	23	27	31	29	31	43	26	46	37	30	30	15	35	16	19	
:15	5	3	0	2	4	13	6	18	18	15	21	42	38	28	29	31	41	30	29	25	20	24	11	9	
:30	0	0	5	0	7	4	8	15	16	27	28	28	26	39	31	47	25	31	21	17	18	15	18	9	
:45	4	0	2	0	10	14	16	16	20	26	21	27	25	24	32	47	25	22	18	21	23	11	9	8	

AM Peak 1100 - 1200 (127), AM PHF=0.77 PM Peak 1530 - 1630 (181), PM PHF=0.96

* Friday, November 04, 2011=2026, 15 minute drops

	0:00	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	24-Hr
Hrly	20	3	9	1	12	13	32	59	71	108	103	117	135	133	125	144	149	149	155	88	95	93	103	113	2030
:00	10	0	1	0	0	5	7	16	25	26	21	26	29	22	39	31	41	47	48	29	21	30	13	59	
:15	4	2	5	1	2	3	10	13	18	29	28	31	31	31	30	35	49	37	48	20	22	25	24	19	
:30	2	1	3	0	6	1	7	13	13	29	24	26	45	48	28	41	26	34	30	20	26	19	19	25	
:45	4	0	0	0	4	4	9	18	15	26	31	35	31	32	29	37	34	32	29	19	26	19	47	10	

AM Peak 1145 - 1245 (139), AM PHF=0.78 PM Peak 1530 - 1630 (167), PM PHF=0.86

* Saturday, November 05, 2011=2026, 15 minute drops

	0:00	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	24-Hr
Hrly	24	6	3	4	12	9	26	53	73	105	121	155	156	161	158	164	183	125	142	68	66	70	102	45	2031
:00	10	2	1	2	4	3	2	14	23	31	18	46	29	47	40	40	61	33	44	18	28	22	20	22	
:15	5	1	0	0	2	0	6	10	15	18	42	39	41	42	54	39	56	30	29	17	19	18	30	11	
:30	1	1	0	2	4	2	6	22	17	33	39	31	37	28	31	36	37	25	40	13	9	14	35	8	
:45	8	2	2	0	2	4	12	7	19	23	23	39	49	44	34	50	30	37	31	20	11	16	17	5	

AM Peak 1100 - 1200 (155), AM PHF=0.85 PM Peak 1545 - 1645 (203), PM PHF=0.84

* Sunday, November 06, 2011=981, 15 minute drops

	0:00	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00
Hrly	15	10	5	3	3	10	21	57	89	97	121	134	106	160	132	-	-	-	-	-	-	-	-	-
:00	7	5	0	0	2	2	2	15	21	24	22	40	26	34	27	-	-	-	-	-	-	-	-	-
:15	4	2	1	0	0	1	2	13	24	28	35	21	30	39	33	-	-	-	-	-	-	-	-	-
:30	1	0	1	1	1	1	6	15	24	18	41	32	26	50	41	-	-	-	-	-	-	-	-	-
:45	3	3	3	2	0	6	11	14	21	28	24	42	25	37	32	-	-	-	-	-	-	-	-	-

AM Peak 1015 - 1115 (139), AM PHF=0.85 PM Peak 1300 - 1400 (160), PM PHF=0.81

24-Hour Traffic Count Data on Kuilima Drive at Kamehameha Highway-Total for Both Directions
Site: Kuilima [Kuilima Drive North] Kuilima Drive Hotel Entrance

* Sunday, October 30, 2011=928 (Incomplete) , 15 minute drops

	0:00	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00
Hrly	-	-	-	-	-	-	-	-	-	-	-	-	-	275	289	289	270	213	181	111	85	59	75	32
:00	-	-	-	-	-	-	-	-	-	-	-	-	-	62	77	87	74	67	54	38	30	23	33	16
:15	-	-	-	-	-	-	-	-	-	-	-	-	-	66	60	74	70	59	49	25	15	9	16	4
:30	-	-	-	-	-	-	-	-	-	-	-	-	-	76	74	69	70	50	47	29	22	12	15	5
:45	-	-	-	-	-	-	-	-	-	-	-	-	-	71	78	59	56	37	31	19	18	15	11	7

PM Peak Gen 14:30 to 15:30 Vol= 313

* Monday, October 31, 2011=1665, 15 minute drops

	0:00	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	24-Hr
Hrly	14	8	2	10	41	58	85	181	177	246	234	261	293	240	258	274	255	205	152	104	86	128	62	37	3411
:00	8	2	1	0	1	14	14	37	52	66	60	64	78	60	71	79	68	61	47	32	20	16	15	12	
:15	2	2	1	0	6	12	25	43	30	49	52	78	71	42	65	66	65	41	36	30	22	55	18	13	
:30	0	0	0	5	10	9	20	49	38	72	49	65	74	74	61	62	58	46	46	24	27	29	17	5	
:45	4	4	0	5	24	23	26	52	57	59	73	54	70	64	61	67	64	57	23	18	17	28	12	7	

AM Peak Gen 10:45 to 11:45 Vol= 280
PM Peak Gen 15:00 to 16:00 Vol= 274

* Tuesday, November 01, 2011=1637, 15 minute drops

	0:00	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	24-Hr
Hrly	11	1	4	11	37	58	86	187	198	186	187	245	261	268	273	270	277	247	192	124	67	89	70	42	3391
:00	6	1	1	4	5	13	15	33	51	47	41	60	55	53	76	74	73	66	55	37	28	17	28	19	
:15	2	0	1	2	10	13	17	34	48	43	56	61	65	67	58	56	72	66	61	28	11	26	7	9	
:30	2	0	0	2	8	10	13	60	52	45	50	62	72	78	77	70	59	61	45	31	8	21	17	8	
:45	1	0	2	3	14	22	41	60	47	51	40	62	69	70	62	70	73	54	31	28	20	25	18	6	

AM Peak Gen 10:45 to 11:45 Vol= 223
PM Peak Gen 15:00 to 16:00 Vol= 270

* Wednesday, November 02, 2011=1661, 15 minute drops

	0:00	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	24-Hr
Hrly	22	2	1	6	43	68	97	171	176	169	250	226	225	301	306	271	296	300	301	173	150	164	97	80	3895
:00	5	1	0	0	8	19	16	23	40	43	63	56	50	67	66	56	103	71	96	41	46	23	37	43	
:15	6	1	1	1	5	13	24	48	48	35	60	53	55	73	79	66	50	101	93	53	32	48	23	16	
:30	10	0	0	2	13	12	18	48	44	43	67	66	55	75	72	73	58	62	55	30	54	56	25	15	
:45	1	0	0	3	17	24	39	52	44	48	60	51	65	86	89	76	85	66	57	49	18	37	12	6	

AM Peak Gen 10:00 to 11:00 Vol= 250
PM Peak Gen 15:15 to 16:15 Vol= 318

* Thursday, November 03, 2011=1952, 15 minute drops

	0:00	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	24-Hr
Hrly	29	5	12	11	49	95	118	179	168	203	235	276	263	256	302	306	273	228	201	174	145	139	88	58	3813
:00	19	2	0	4	1	22	29	30	42	44	71	77	55	71	79	58	80	55	54	51	37	47	25	25	
:15	5	3	1	4	8	25	17	39	39	43	57	73	76	65	60	71	70	56	65	46	39	45	15	12	
:30	1	0	5	1	11	16	24	56	38	54	59	62	69	66	72	88	64	68	42	39	37	31	31	10	
:45	4	0	6	2	29	32	48	54	49	62	48	64	63	54	91	89	59	49	40	38	32	16	17	11	

AM Peak Gen 11:00 to 12:00 Vol= 276
PM Peak Gen 14:45 to 15:45 Vol= 308

* Friday, November 04, 2011=2234, 15 minute drops

	0:00	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	24-Hr
Hrly	23	8	18	9	42	64	132	190	239	246	314	264	286	266	279	310	312	291	253	186	148	132	149	128	4289
:00	12	1	1	1	3	14	22	34	70	53	75	74	75	47	70	66	82	79	83	55	39	45	28	64	
:15	4	4	10	3	7	19	38	41	60	73	83	73	67	66	54	76	89	81	70	46	31	35	35	24	
:30	3	3	7	4	9	8	29	52	52	53	75	52	79	82	75	89	60	65	54	51	43	25	26	28	
:45	4	0	0	1	23	23	43	63	57	67	81	65	65	71	80	79	81	66	46	34	35	27	60	12	

AM Peak Gen 10:00 to 11:00 Vol= 314
PM Peak Gen 16:00 to 17:00 Vol= 312

* Saturday, November 05, 2011=2214, 15 minute drops

	0:00	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	24-Hr
Hrly	45	9	6	9	33	34	93	213	190	224	261	286	330	354	366	343	350	260	262	158	125	117	142	61	4271
:00	15	2	4	4	6	4	13	40	45	65	50	80	67	98	88	82	97	61	81	43	45	29	28	25	
:15	12	1	0	2	6	7	22	43	40	46	86	72	81	91	92	85	95	67	59	44	40	31	36	14	
:30	5	4	0	2	11	8	23	70	43	63	66	63	75	72	88	80	85	58	66	39	18	34	52	14	
:45	13	2	2	1	10	15	35	60	62	50	59	71	107	93	98	96	73	74	56	32	22	23	26	8	

AM Peak Gen 11:00 to 12:00 Vol= 286
PM Peak Gen 12:30 to 13:30 Vol= 371

* Sunday, November 06, 2011=1386, 15 minute drops

	0:00	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00
Hrly	19	14	9	8	25	39	77	178	222	232	234	288	282	369	357	-	-	-	-	-	-	-	-	-
:00	7	7	1	0	4	5	8	38	60	53	43	74	74	89	84	-	-	-	-	-	-	-	-	-
:15	5	3	1	1	3	9	13	39	55	54	57	67	72	83	82	-	-	-	-	-	-	-	-	-
:30	3	0	1	3	11	7	26	49	57	48	77	74	66	107	99	-	-	-	-	-	-	-	-	-
:45	4	4	6	4	7	18	30	52	50	77	57	73	70	90	92	-	-	-	-	-	-	-	-	-

AM Peak Gen 11:00 to 12:00 Vol= 288

Weekday Turning Movement Count Data
Study Name: Kamehameha Hwy Joseph P Leong Hwy Wkdy
Start Date: 11/01/2011

Vehicular Traffic

		Eastbound		Northbound		Southbound			
		Kamehameha Hwy		Joseph P Leong Hwy		Kamehameha Hwy			
Start Time	End Time	Left-Turn	Right-Turn	Left-Turn	Through	Through	Right-Turn	Total	Hrly Total
6:30 AM	6:45 AM	18	2	1	45	56	14	136	
6:45 AM	7:00 AM	30	1	1	64	84	16	196	
7:00 AM	7:15 AM	27	0	2	53	75	29	186	
7:15 AM	7:30 AM	27	2	3	63	96	36	227	745
7:30 AM	7:45 AM	34	3	3	60	97	30	227	836
7:45 AM	8:00 AM	21	0	4	62	84	55	226	866
8:00 AM	8:15 AM	41	4	2	70	78	53	248	928
8:15 AM	8:30 AM	36	4	2	52	65	47	206	907
8:30 AM	8:45 AM	35	4	4	47	68	50	208	888
8:45 AM	9:00 AM	45	2	4	50	70	48	219	881
9:00 AM	9:15 AM	36	4	4	59	67	59	229	862
9:15 AM	9:30 AM	42	1	6	57	79	46	231	887
9:30 AM	9:45 AM	42	3	5	49	62	58	219	898
9:45 AM	10:00 AM	48	4	3	74	54	57	240	919
10:00 AM	10:15 AM	61	2	7	66	61	68	265	955
10:15 AM	10:30 AM	55	7	6	64	68	66	266	990
10:30 AM	10:45 AM	63	2	8	57	66	60	256	1027
10:45 AM	11:00 AM	72	4	17	68	57	84	**302**	1089
11:00 AM	11:15 AM	56	10	11	53	55	81	266	1090
11:15 AM	11:30 AM	71	11	7	71	66	75	301	1125
11:30 AM	11:45 AM	53	2	8	72	54	71	260	**1129**
11:45 AM	12:00 PM	66	4	11	63	49	58	251	1078
12:00 PM	12:15 PM	82	3	9	65	55	72	286	1098
12:15 PM	12:30 PM	71	6	17	72	65	84	315	1112
12:30 PM	12:45 PM	86	10	11	71	70	81	329	1181
12:45 PM	1:00 PM	93	7	7	72	47	93	319	1249
1:00 PM	1:15 PM	76	4	15	94	68	82	339	1302
1:15 PM	1:30 PM	96	5	12	82	65	83	343	1330
1:30 PM	1:45 PM	83	13	5	72	64	76	313	1314
1:45 PM	2:00 PM	67	7	9	97	73	75	328	1323
2:00 PM	2:15 PM	83	16	12	76	74	78	339	1323
2:15 PM	2:30 PM	94	7	11	90	44	93	339	1319
2:30 PM	2:45 PM	75	6	10	62	73	76	302	1308
2:45 PM	3:00 PM	81	6	6	92	81	98	364	1344
3:00 PM	3:15 PM	76	2	13	105	87	85	368	1373
3:15 PM	3:30 PM	82	7	17	93	81	101	381	1415
3:30 PM	3:45 PM	82	3	5	96	104	99	**389**	**1502**
3:45 PM	4:00 PM	91	4	11	83	62	68	319	1457
4:00 PM	4:15 PM	84	4	5	97	68	75	333	1422
4:15 PM	4:30 PM	71	9	5	107	70	76	338	1379

AM Peak Hour								
10:45 AM	11:45 AM	252	27	43	264	232	311	1129
Peak Hour Factor		0.88	1.69	0.63	0.97	1.02	0.93	0.93
Heavy Vehicles %		5.2%	0.0%	0.0%	5.7%	3.4%	3.2%	4.1%
PM Peak Hour								
2:45 PM	3:45 PM	321	18	41	386	353	383	1502
Peak Hour Factor		0.98	1.50	2.05	1.01	0.85	0.97	0.97
Heavy Vehicles %		0.6%	0.0%	0.0%	0.3%	4.8%	1.6%	1.7%

Saturday Turning Movement Count Data
Study Name: Kamehameha Hwy Haleiwa Bypass Sat 1130-1530
Start Date: 10/29/2011 Saturday

Vehicular Traffic

		Eastbound		Northbound		Southbound			
		Kamehameha Hwy		Joseph P Leong Hwy		Kamehameha Hwy			
Start Time	End Time	Left-Turn	Right-Turn	Left-Turn	Through	Through	Right-Turn	Total	Hrly Total
10:30 AM	10:45 AM	76	17	15	100	76	79	363	
10:45 AM	11:00 AM	85	10	15	92	59	81	342	
11:00 AM	11:15 AM	98	9	15	100	59	79	360	
11:15 AM	11:30 AM	98	12	13	90	70	73	356	1421
11:30 AM	11:45 AM	85	9	14	96	77	89	370	1428
11:45 AM	12:00 PM	89	3	24	128	80	86	410	1496
12:00 PM	12:15 PM	83	9	14	106	84	113	409	1545
12:15 PM	12:30 PM	105	14	15	109	95	118	**456**	1645
12:30 PM	12:45 PM	72	13	19	107	102	94	407	**1682**
12:45 PM	1:00 PM	79	5	17	98	70	80	349	1621
1:00 PM	1:15 PM	102	7	14	89	72	99	383	1595
1:15 PM	1:30 PM	94	14	12	91	80	96	387	1526
1:30 PM	1:45 PM	84	9	19	96	86	80	374	1493
1:45 PM	2:00 PM	90	14	11	92	79	99	385	1529
2:00 PM	2:15 PM	73	6	10	99	88	102	378	1524
2:15 PM	2:30 PM	97	11	13	87	84	77	369	1506
2:30 PM	2:45 PM	62	17	8	105	92	88	372	1504
2:45 PM	3:00 PM	85	12	12	85	90	74	358	1477
3:00 PM	3:15 PM	79	22	11	114	117	103	446	1545
3:15 PM	3:30 PM	67	8	12	83	112	72	354	1530
3:30 PM	3:45 PM	83	15	12	93	102	111	416	1574
3:45 PM	4:00 PM	57	10	11	97	85	97	357	1573
4:00 PM	4:15 PM	68	11	8	76	89	77	329	1456
4:15 PM	4:30 PM	77	8	11	97	96	75	364	1466

Saturday Peak Hour

11:45 AM	12:45 PM	349	39	72	450	361	411	1682
Peak Hour Factor		0.83	0.70	1.20	1.03	0.95	0.87	0.92
Heavy Vehicles		1.1%	0.0%	0.0%	2.9%	0.6%	1.7%	1.5%

Sunday Turning Movement Count Data

Study Name Kamehameha Hwy Haleiwa Bypass Sun 1100-1400

Start Date 3/4/2012

Vehicular Traffic

		Eastbound		Northbound		Southbound			
		Kamehameha Hwy		Joseph P Leong Hwy		Kamehameha Hwy			
Start Time	End Time	Left-Turn	Right-Turn	Left-Turn	Through	Through	Right-Turn	Total	Hrly Total
11:00 AM	11:15 AM	94	9	20	55	68	118	364	
11:15 AM	11:30 AM	94	10	29	82	65	115	395	
11:30 AM	11:45 AM	93	21	30	80	65	94	383	
11:45 AM	12:00 PM	116	21	30	59	68	97	391	1533
12:00 PM	12:15 PM	95	10	21	71	66	102	365	1534
12:15 PM	12:30 PM	88	23	24	70	51	106	362	1501
12:30 PM	12:45 PM	91	16	34	63	82	120	406	1524
12:45 PM	1:00 PM	94	16	28	72	68	110	388	1521
1:00 PM	1:15 PM	93	18	16	67	66	113	373	1529
1:15 PM	1:30 PM	116	21	29	84	77	111	**438**	**1605**
1:30 PM	1:45 PM	112	20	11	78	85	89	395	1594
1:45 PM	2:00 PM	105	28	18	69	71	71	362	1568

Sunday Peak Hour

12:30 PM	1:30 PM	394	71	107	286	293	454	1605
Peak Hour Factor		0.85	0.85	0.92	0.85	0.95	1.02	0.92

Weekday Turning Movement Count Data
Study Name: Kamehameha Hwy Kahekili Hwy Weekday
Start Date: 11/01/2011

Vehicular Traffic

		Westbound		Northbound		Southbound			
		Kamehameha Hwy		Kahekili Hwy		Kamehameha Hwy			
Start Time	End Time	Left-Turn	Right-Turn	Through	Right-Turn	Left-Turn	Through	Total	Hrly Total
5:15 AM	5:30 AM	15	5	29	5	5	106	165	
5:30 AM	5:45 AM	13	6	34	11	9	153	226	
5:45 AM	6:00 AM	12	4	34	5	22	140	217	
6:00 AM	6:15 AM	11	3	45	16	72	129	276	884
6:15 AM	6:30 AM	5	7	38	24	102	72	248	967
6:30 AM	6:45 AM	4	11	51	28	104	76	274	1015
6:45 AM	7:00 AM	4	16	58	36	126	93	333	1131
7:00 AM	7:15 AM	12	24	79	38	136	92	**381**	1236
7:15 AM	7:30 AM	9	11	59	33	84	109	305	1293
7:30 AM	7:45 AM	10	30	112	19	71	78	320	**1339**
7:45 AM	8:00 AM	9	38	92	21	53	96	309	1315
8:00 AM	8:15 AM	12	24	83	17	22	120	278	1212
8:15 AM	8:30 AM	10	29	94	12	15	120	280	1187
8:30 AM	8:45 AM	5	19	72	19	27	144	286	1153
8:45 AM	9:00 AM	13	11	77	14	15	136	266	1110
9:00 AM	9:15 AM	16	19	86	14	9	143	287	1119
9:15 AM	9:30 AM	13	14	77	15	11	108	238	1077
9:30 AM	9:45 AM	9	16	74	10	16	107	232	1023
9:45 AM	10:00 AM	13	23	87	13	9	96	241	998
10:00 AM	10:15 AM	14	16	88	9	12	112	251	962
10:15 AM	10:30 AM	10	28	88	9	16	122	273	997
10:30 AM	10:45 AM	14	21	74	10	17	95	231	996
10:45 AM	11:00 AM	7	37	105	12	16	122	299	1054
11:00 AM	11:15 AM	11	31	119	8	12	101	282	1085
11:15 AM	11:30 AM	7	37	102	15	11	114	286	1098
11:30 AM	11:45 AM	6	27	131	9	17	96	286	**1153**
11:45 AM	12:00 PM	13	21	93	11	8	108	254	1108
12:00 PM	12:15 PM	12	28	108	10	12	101	271	1097
12:15 PM	12:30 PM	6	37	107	10	10	101	271	1082
12:30 PM	12:45 PM	10	36	115	15	10	97	283	1079
12:45 PM	1:00 PM	8	37	120	13	20	109	307	1132
1:00 PM	1:15 PM	12	43	117	19	15	107	313	1174
1:15 PM	1:30 PM	12	24	114	18	19	104	291	1194
1:30 PM	1:45 PM	14	49	129	10	24	106	332	1243
1:45 PM	2:00 PM	16	40	115	14	12	114	311	1247
2:00 PM	2:15 PM	10	31	122	18	14	134	329	1263
2:15 PM	2:30 PM	12	23	111	13	29	171	359	1331
2:30 PM	2:45 PM	10	29	110	11	23	124	307	1306
2:45 PM	3:00 PM	8	40	134	13	13	108	316	1311
3:00 PM	3:15 PM	13	37	141	17	19	140	367	1349
3:15 PM	3:30 PM	9	61	164	17	13	122	386	1376
3:30 PM	3:45 PM	13	61	166	19	16	142	**417**	1486
3:45 PM	4:00 PM	13	52	159	10	23	154	411	1581
4:00 PM	4:15 PM	10	73	157	13	13	132	398	1612
4:15 PM	4:30 PM	14	53	151	22	23	144	407	**1633**
4:30 PM	4:45 PM	9	71	143	13	15	129	380	1596
4:45 PM	5:00 PM	11	80	131	20	14	124	380	1565
5:00 PM	5:15 PM	15	72	115	19	19	135	375	1542
5:15 PM	5:30 PM	14	67	151	20	15	111	378	1513
5:30 PM	5:45 PM	10	81	114	21	17	120	363	1496
5:45 PM	6:00 PM	12	52	128	12	18	114	336	1452
6:00 PM	6:15 PM	9	53	144	16	15	114	351	1428
6:15 PM	6:30 PM	10	49	133	9	13	104	318	1368

AM Peak Hour								
6:45 AM	7:45 AM	35	81	308	126	417	372	1339
Peak Hour Factor		0.73	0.84	0.97	0.83	0.77	1.01	0.88
Heavy Vehicles		5.7%	7.4%	4.5%	4.0%	2.2%	2.7%	3.4%

PM Peak Hour								
3:30 PM	4:30 PM	50	239	633	64	75	572	1633
Peak Hour Factor		0.96	0.98	0.95	0.84	1.17	1.01	0.98
Heavy Vehicles		6.0%	5.4%	3.0%	4.7%	2.7%	1.6%	3.0%

Saturday Turning Movement Count Data
Study Name: Kamehameha Hwy Kahekili Hwy Sat 1130-1530
Start Date: 10/29/2011 Saturday

Vehicular Traffic

		Westbound		Northbound		Southbound			
		Kamehameha Hwy		Kahekili Hwy		Kamehameha Hwy			
Start Time	End Time	Left-Turn	Right-Turn	Through	Right-Turn	Left-Turn	Through	Total	Hrly Total
11:00 AM	11:15 AM	6	54	152	17	18	146	393	
11:15 AM	11:30 AM	13	43	144	18	17	118	353	
11:30 AM	11:45 AM	10	43	124	15	16	172	380	
11:45 AM	12:00 PM	13	47	157	13	16	124	370	1496
12:00 PM	12:15 PM	18	46	149	27	22	133	395	1498
12:15 PM	12:30 PM	11	59	128	16	20	136	370	1515
12:30 PM	12:45 PM	10	61	140	15	23	135	384	1519
12:45 PM	1:00 PM	8	49	167	16	24	171	435	1584
1:00 PM	1:15 PM	9	77	152	22	18	101	379	1568
1:15 PM	1:30 PM	9	60	141	17	17	149	393	1591
1:30 PM	1:45 PM	7	53	133	17	18	146	374	1581
1:45 PM	2:00 PM	14	55	142	15	21	154	401	1547
2:00 PM	2:15 PM	17	60	142	21	18	123	381	1549
2:15 PM	2:30 PM	11	62	137	17	16	156	399	1555
2:30 PM	2:45 PM	9	43	163	24	22	168	**429**	1610
2:45 PM	3:00 PM	13	47	154	16	16	146	392	1601
3:00 PM	3:15 PM	13	55	141	20	14	149	392	**1612**
3:15 PM	3:30 PM	14	48	133	16	16	140	367	1580
3:30 PM	3:45 PM	11	37	142	19	10	158	377	1528
3:45 PM	4:00 PM	10	38	144	19	17	159	387	1523

Saturday Peak Hour								
2:15 PM	3:15 PM	46	207	595	77	68	619	1612
Peak Hour Factor		1.28	1.20	0.91	0.80	0.77	0.92	0.94
Heavy Vehicles		6.5%	1.9%	2.4%	2.6%	4.4%	3.1%	2.8%

Sunday Turning Movement Count Data

Study Name Kam Hwy Kahekili Hwy Sunday

Start Date 3/11/2012

Vehicular Traffic

		Westbound		Northbound		Southbound			
		Kamehameha Hwy		Kahekili Hwy		Kamehameha Hwy			
Start Time	End Time	Left-Turn	Right-Turn	Through	Right-Turn	Left-Turn	Through	Total	Hrly Total
12:30 PM	12:45 PM	16	40	116	9	19	129	329	
12:45 PM	1:00 PM	8	41	133	9	16	136	343	
1:00 PM	1:15 PM	11	38	120	15	19	127	330	
1:15 PM	1:30 PM	14	71	104	27	18	128	362	1364
1:30 PM	1:45 PM	20	58	119	9	19	105	330	1365
1:45 PM	2:00 PM	18	45	148	22	16	110	359	1381
2:00 PM	2:15 PM	6	56	131	20	15	140	368	1419
2:15 PM	2:30 PM	19	41	142	19	15	140	**376**	**1433**
2:30 PM	2:45 PM	8	46	106	15	22	132	329	1432
2:45 PM	3:00 PM	11	44	124	16	11	142	348	1421
3:00 PM	3:15 PM	7	29	106	9	16	119	286	1339
3:15 PM	3:30 PM	16	32	116	20	9	154	347	1310
3:30 PM	3:45 PM	8	37	109	16	12	114	296	1277
3:45 PM	4:00 PM	15	34	101	14	20	157	341	1270
4:00 PM	4:15 PM	10	35	98	17	14	154	328	1312
4:15 PM	4:30 PM	16	33	86	20	13	160	328	1293

Sunday Peak Hour								
1:30 PM	2:30 PM	63	200	540	70	65	495	1433
Peak Hour Factor		0.83	1.22	0.95	0.92	1.08	0.88	0.95
Heavy Vehicles		1.6%	1.5%	0.9%	2.9%	1.5%	2.2%	1.6%

Sunday Turning Movement Count Data

Study Name Haleiwa Farmers Market Trip Generation

Start Date 6/10/2012

Vehicular Traffic

		Eastbound Kamehameha Hwy		Westbound Kamehameha Hwy		Farmers Market Southbound Street		Intersection		Farmers Market			
Start Time	End Time	Left-Turn	Through	Through	Right-Turn	Left-Turn	Right-Turn	Total	Hrly Total	Site Enter	Site Exit	Site Total	Hrly Total
9:00 AM	9:15 AM	10	47	56	20	2	13	148		30	15	45	
9:15 AM	9:30 AM	9	68	60	24	6	16	183		33	22	55	
9:30 AM	9:45 AM	10	66	49	21	4	16	166		31	20	51	
9:45 AM	10:00 AM	7	76	90	30	2	14	219	716	37	16	53	204
10:00 AM	10:15 AM	15	96	73	32	8	18	242	810	47	26	73	232
10:15 AM	10:30 AM	10	72	78	28	6	20	214	841	38	26	64	241
10:30 AM	10:45 AM	13	83	75	24	6	26	227	902	37	32	69	259
10:45 AM	11:00 AM	11	88	114	26	4	23	266	949	37	27	64	270
11:00 AM	11:15 AM	11	113	102	31	5	28	290	997	42	33	75	272
11:15 AM	11:30 AM	3	100	104	34	9	18	268	1051	37	27	64	272
11:30 AM	11:45 AM	10	121	107	31	8	21	298	1122	41	29	70	273
11:45 AM	12:00 PM	6	117	114	23	13	24	297	1153	29	37	66	**275**
12:00 PM	12:15 PM	9	94	112	18	5	26	264	1127	27	31	58	258
12:15 PM	12:30 PM	2	124	118	28	5	24	301	1160	30	29	59	253
12:30 PM	12:45 PM	6	114	99	20	5	21	265	1127	26	26	52	235
12:45 PM	1:00 PM	14	120	112	19	4	33	302	1132	33	37	70	239
1:00 PM	1:15 PM	1	121	125	18	12	19	296	1164	19	31	50	231
1:15 PM	1:30 PM	4	123	122	13	4	33	299	1162	17	37	54	226
1:30 PM	1:45 PM	3	128	133	2	14	25	305	**1202**	5	39	44	218
1:45 PM	2:00 PM	3	102	100	0	9	8	222	1122	3	17	20	168
2:00 PM	2:15 PM	1	106	93	0	2	6	208	1034	1	8	9	127
2:15 PM	2:30 PM	2	115	130	1	2	6	256	991	3	8	11	84
2:30 PM	2:45 PM	1	123	138	0	0	4	266	952	1	4	5	45
2:45 PM	3:00 PM	0	113	122	0	1	0	236	966	0	1	1	26

Peak Hour

11:00 AM	12:00 PM	30	451	427	119	35	91	1153		149	126	275
2:00 PM	3:00 PM	4	457	483	1	5	16	966		5	21	26

TRAFFIC IMPACT ANALYSIS REPORT

FOR THE PROPOSED

TURTLE BAY RESORT MASTER PLAN

KAHUKU, OAHU, HAWAII

APPENDIX B

CAPACITY ANALYSIS WORKSHEETS

EXISTING TRAFFIC CONDITIONS

Intersection	
Intersection Delay (sec/veh):	3.8

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Volume (vph)	82	169	182	62	70	84
Conflicting Peds.(#/hr)	1	0	0	1	7	0
Sign Control	Free	Free	Free	Free	Stop	Stop
Right Turn Channelized	None	None	Yield	Yield	Free	Free
Storage Length	0			0	0	0
Median Width		0	0		12	
Grade (%)		0%	0%		0%	
Peak Hour Factor	0.93	1.00	0.77	1.00	0.97	1.00
Heavy Vehicles(%)	4	13	6	7	6	7
Movement Flow Rate	88	169	236	62	72	84
Number of Lanes	0	1	1	0	1	1

Major/Minor	Major 1		Major 2			
Conflicting Flow Rate - All	305	0	0	0	619	275
Stage 1	-	-	-	-	274	-
Stage 2	-	-	-	-	345	-
Follow-up Headway	2.236	-	-	-	3.554	3.363
Pot Capacity-1 Maneuver	1244	-	-	-	446	752
Stage 1	-	-	-	-	763	-
Stage 2	-	-	-	-	708	-
Time blocked-Platoon(%)	0	-	-	-	0	0
Mov Capacity-1 Maneuver	1243	-	-	-	406	747
Mov Capacity-2 Maneuver	-	-	-	-	406	-
Stage 1	-	-	-	-	759	-
Stage 2	-	-	-	-	649	-

Approach	EB	WB	SB
HCM Control Delay (s)	2.8	0	12.9
HCM LOS	A	A	B

Lane	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (vph)					406	747
HCM Control Delay (s)	8.117	-	-	-	15.8	10.4
HCM Lane VC Ratio	0.071	-	-	-	0.178	0.112
HCM Lane LOS	A	-	-	-	C	B
HCM 95th Percentile Queue (veh)	0.229	-	-	-	0.639	0.378

Intersection	
Intersection Delay (sec/veh):	0.2

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Volume (vph)	1	233	248	6	6	4
Conflicting Peds.(#/hr)	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
Right Turn Channelized	None	None	None	None	None	None
Storage Length	0			0	0	0
Median Width		0	0		12	
Grade (%)		0%	0%		0%	
Peak Hour Factor	1.00	0.82	0.87	1.00	1.00	1.00
Heavy Vehicles(%)	0	13	6	0	0	0
Movement Flow Rate	1	284	285	6	6	4
Number of Lanes	0	1	1	0	1	0

Major/Minor	Major 1		Major 2			
Conflicting Flow Rate - All	291	0	0	0	574	288
Stage 1	-	-	-	-	288	-
Stage 2	-	-	-	-	286	-
Follow-up Headway	2.2	-	-	-	3.5	3.3
Pot Capacity-1 Maneuver	1282	-	-	-	484	756
Stage 1	-	-	-	-	766	-
Stage 2	-	-	-	-	767	-
Time blocked-Platoon(%)	0	-	-	-	0	0
Mov Capacity-1 Maneuver	1282	-	-	-	484	756
Mov Capacity-2 Maneuver	-	-	-	-	484	-
Stage 1	-	-	-	-	766	-
Stage 2	-	-	-	-	766	-

Approach	EB	WB	SB
HCM Control Delay (s)	0	0	11.5
HCM LOS	A	A	B

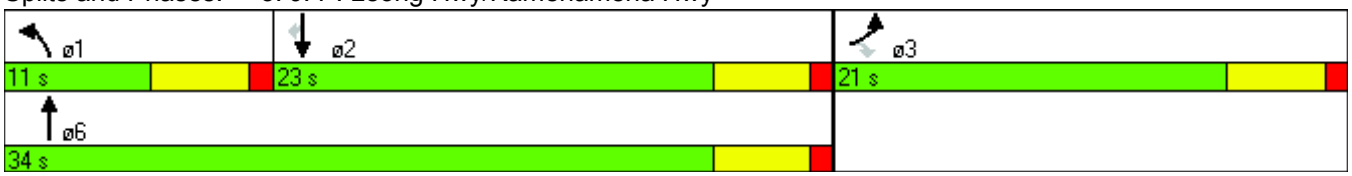
Lane	EBL	EBT	WBT	WBR	SBLn1
Capacity (vph)					565
HCM Control Delay (s)	7.81	-	-	-	11.5
HCM Lane VC Ratio	0.001	-	-	-	0.018
HCM Lane LOS	A	-	-	-	B
HCM 95th Percentile Queue (veh)	0.002	-	-	-	0.054

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	252	27	43	264	232	311
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0	0	0			450
Storage Lanes	1	1	1			1
Taper Length (ft)	100		100			
Satd. Flow (prot)	1719	1615	1805	1792	1845	1568
Flt Permitted	0.950		0.950			
Satd. Flow (perm)	1719	1615	1805	1792	1845	1568
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)		139				334
Link Speed (mph)	30			30	30	
Link Distance (ft)	220			382	754	
Travel Time (s)	5.0			8.7	17.1	
Peak Hour Factor	0.88	1.00	0.63	0.97	1.00	0.93
Heavy Vehicles (%)	5%	0%	0%	6%	3%	3%
Shared Lane Traffic (%)						
Lane Group Flow (vph)	286	27	68	272	232	334
Turn Type	NA	Perm	Prot	NA	NA	Perm
Protected Phases	3		1	6	2	
Permitted Phases		3				2
Detector Phase	3	3	1	6	2	2
Switch Phase						
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	21.0	21.0	9.0	9.0	21.0	21.0
Total Split (s)	21.0	21.0	11.0	34.0	23.0	23.0
Total Split (%)	38.2%	38.2%	20.0%	61.8%	41.8%	41.8%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag			Lead		Lag	Lag
Lead-Lag Optimize?						
Recall Mode	None	None	None	None	Max	Max
Act Effct Green (s)	12.7	12.7	6.0	24.5	20.8	20.8
Actuated g/C Ratio	0.26	0.26	0.12	0.49	0.42	0.42
v/c Ratio	0.65	0.05	0.31	0.31	0.30	0.39
Control Delay	24.4	0.2	26.1	8.3	13.9	3.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	24.4	0.2	26.1	8.3	13.9	3.7
LOS	C	A	C	A	B	A
Approach Delay	22.3			11.9	7.9	
Approach LOS	C			B	A	
Queue Length 50th (ft)	79	0	20	39	53	0
Queue Length 95th (ft)	140	0	36	82	107	45
Internal Link Dist (ft)	140			302	674	
Turn Bay Length (ft)						450
Base Capacity (vph)	564	623	221	1065	771	849
Starvation Cap Reductn	0	0	0	0	0	0

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.51	0.04	0.31	0.26	0.30	0.39

Intersection Summary	
Area Type: Other	
Cycle Length: 55	
Actuated Cycle Length: 49.7	
Natural Cycle: 55	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 0.65	
Intersection Signal Delay: 12.7	Intersection LOS: B
Intersection Capacity Utilization 42.0%	ICU Level of Service A
Analysis Period (min) 15	

Splits and Phases: 3: J. P. Leong Hwy/Kamehameha Hwy



Intersection	
Intersection Delay (sec/veh):	78

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Volume (vph)	36	81	308	126	417	372
Conflicting Peds.(#/hr)	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
Right Turn Channelized	Yield	Yield	Yield	Yield	None	None
Storage Length	0	0		200	0	
Median Width	12		0			0
Grade (%)	0%		0%			0%
Peak Hour Factor	0.73	0.84	0.97	0.83	0.70	1.00
Heavy Vehicles(%)	6	7	5	4	2	3
Movement Flow Rate	49	96	318	152	596	372
Number of Lanes	1	0	1	1	0	1

Major/Minor			Major 1		Major 2	
Conflicting Flow Rate - All	1958	235	0	0	470	0
Stage 1	394	-	-	-	-	-
Stage 2	1564	-	-	-	-	-
Follow-up Headway	3.554	3.363	-	-	2.218	-
Pot Capacity-1 Maneuver	68	792	-	-	1092	-
Stage 1	673	-	-	-	-	-
Stage 2	186	-	-	-	-	-
Time blocked-Platoon(%)	0	0	-	-	0	-
Mov Capacity-1 Maneuver	# 21	792	-	-	1092	-
Mov Capacity-2 Maneuver	# 21	-	-	-	-	-
Stage 1	673	-	-	-	-	-
Stage 2	58	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay (s)	$ 797.6	0	7.5
HCM LOS	F	A	A

Lane	NBT	NBR	WBLn1	SBL	SBT
Capacity (vph)			60		
HCM Control Delay (s)	-	-	$ 797.6	12.18	-
HCM Lane VC Ratio	-	-	2.429	0.546	-
HCM Lane LOS	-	-	F	B	-
HCM 95th Percentile Queue (veh)	-	-	14.49	3.413	-

Intersection	
Intersection Delay (sec/veh):	3.6

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Volume (vph)	104	240	277	76	70	91
Conflicting Peds.(#/hr)	0	0	0	0	3	1
Sign Control	Free	Free	Free	Free	Stop	Stop
Right Turn Channelized	None	None	Yield	Yield	Free	Free
Storage Length	0			0	0	0
Median Width		0	0		12	
Grade (%)		0%	0%		0%	
Peak Hour Factor	1.00	0.76	0.85	0.95	1.00	0.91
Heavy Vehicles(%)	2	3	5	8	4	7
Movement Flow Rate	104	316	326	80	70	100
Number of Lanes	0	1	1	0	1	1

Major/Minor	Major 1		Major 2			
Conflicting Flow Rate - All	409	0	0	0	893	369
Stage 1	-	-	-	-	369	-
Stage 2	-	-	-	-	524	-
Follow-up Headway	2.218	-	-	-	3.536	3.363
Pot Capacity-1 Maneuver	1150	-	-	-	309	666
Stage 1	-	-	-	-	695	-
Stage 2	-	-	-	-	590	-
Time blocked-Platoon(%)	0	-	-	-	0	0
Mov Capacity-1 Maneuver	1150	-	-	-	274	664
Mov Capacity-2 Maneuver	-	-	-	-	274	-
Stage 1	-	-	-	-	693	-
Stage 2	-	-	-	-	524	-

Approach	EB	WB	SB
HCM Control Delay (s)	2.1	0	16
HCM LOS	A	A	C

Lane	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (vph)					274	664
HCM Control Delay (s)	8.441	-	-	-	22.6	11.4
HCM Lane VC Ratio	0.09	-	-	-	0.255	0.151
HCM Lane LOS	A	-	-	-	C	B
HCM 95th Percentile Queue (veh)	0.298	-	-	-	0.991	0.528

Intersection	
Intersection Delay (sec/veh):	0.3

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Volume (vph)	2	304	345	7	7	3
Conflicting Peds.(#/hr)	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
Right Turn Channelized	None	None	None	None	None	None
Storage Length	0			0	0	0
Median Width		0	0		12	
Grade (%)		0%	0%		0%	
Peak Hour Factor	0.25	0.86	0.90	1.00	1.00	0.75
Heavy Vehicles(%)	0	3	5	0	0	0
Movement Flow Rate	8	353	383	7	7	4
Number of Lanes	0	1	1	0	1	0

Major/Minor	Major 1		Major 2			
Conflicting Flow Rate - All	390	0	0	0	756	387
Stage 1	-	-	-	-	387	-
Stage 2	-	-	-	-	369	-
Follow-up Headway	2.2	-	-	-	3.5	3.3
Pot Capacity-1 Maneuver	1180	-	-	-	379	665
Stage 1	-	-	-	-	691	-
Stage 2	-	-	-	-	704	-
Time blocked-Platoon(%)	0	-	-	-	0	0
Mov Capacity-1 Maneuver	1180	-	-	-	376	665
Mov Capacity-2 Maneuver	-	-	-	-	376	-
Stage 1	-	-	-	-	691	-
Stage 2	-	-	-	-	698	-

Approach	EB	WB	SB
HCM Control Delay (s)	0.2	0	13.3
HCM LOS	A	A	B

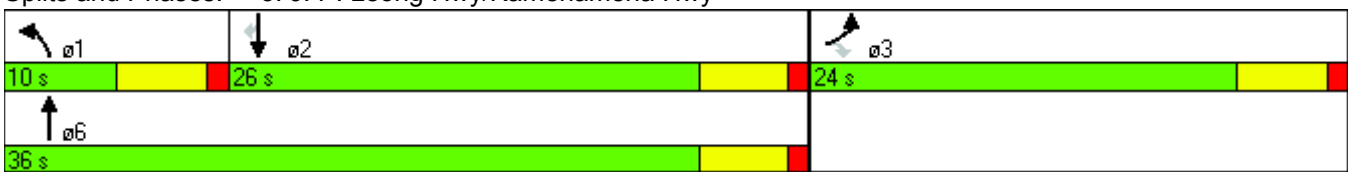
Lane	EBL	EBT	WBT	WBR	SBLn1
Capacity (vph)					447
HCM Control Delay (s)	8.072	-	-	-	13.3
HCM Lane VC Ratio	0.007	-	-	-	0.025
HCM Lane LOS	A	-	-	-	B
HCM 95th Percentile Queue (veh)	0.02	-	-	-	0.076

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	321	18	41	386	353	383
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0	0	0			450
Storage Lanes	1	1	1			1
Taper Length (ft)	100		100			
Satd. Flow (prot)	1787	1615	1805	1900	1810	1583
Flt Permitted	0.950		0.950			
Satd. Flow (perm)	1787	1615	1805	1900	1810	1583
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)		127				407
Link Speed (mph)	30			30	30	
Link Distance (ft)	220			382	754	
Travel Time (s)	5.0			8.7	17.1	
Peak Hour Factor	0.95	0.64	0.60	1.00	1.00	0.94
Heavy Vehicles (%)	1%	0%	0%	0%	5%	2%
Shared Lane Traffic (%)						
Lane Group Flow (vph)	338	28	68	386	353	407
Turn Type	NA	Perm	Prot	NA	NA	Perm
Protected Phases	3		1	6	2	
Permitted Phases		3				2
Detector Phase	3	3	1	6	2	2
Switch Phase						
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	21.0	21.0	9.0	9.0	21.0	21.0
Total Split (s)	24.0	24.0	10.0	36.0	26.0	26.0
Total Split (%)	40.0%	40.0%	16.7%	60.0%	43.3%	43.3%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag			Lead		Lag	Lag
Lead-Lag Optimize?						
Recall Mode	None	None	None	None	Max	Max
Act Effct Green (s)	14.5	14.5	5.1	28.1	22.7	22.7
Actuated g/C Ratio	0.27	0.27	0.10	0.53	0.43	0.43
v/c Ratio	0.69	0.05	0.39	0.38	0.45	0.45
Control Delay	25.6	0.2	32.2	9.3	15.8	3.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	25.6	0.2	32.2	9.3	15.8	3.7
LOS	C	A	C	A	B	A
Approach Delay	23.7			12.7	9.3	
Approach LOS	C			B	A	
Queue Length 50th (ft)	101	0	22	66	90	0
Queue Length 95th (ft)	176	0	38	131	173	50
Internal Link Dist (ft)	140			302	674	
Turn Bay Length (ft)						450
Base Capacity (vph)	656	673	174	1139	778	913
Starvation Cap Reductn	0	0	0	0	0	0

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.52	0.04	0.39	0.34	0.45	0.45

Intersection Summary	
Area Type: Other	
Cycle Length: 60	
Actuated Cycle Length: 52.8	
Natural Cycle: 55	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 0.69	
Intersection Signal Delay: 13.6	Intersection LOS: B
Intersection Capacity Utilization 52.2%	ICU Level of Service A
Analysis Period (min) 15	

Splits and Phases: 3: J. P. Leong Hwy/Kamehameha Hwy



Intersection	
Intersection Delay (sec/veh):	2.8

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Volume (vph)	50	239	633	64	75	572
Conflicting Peds.(#/hr)	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
Right Turn Channelized	Yield	Yield	Yield	Yield	None	None
Storage Length	0	0		200	0	
Median Width	12		0			0
Grade (%)	0%		0%			0%
Peak Hour Factor	0.96	0.98	0.95	0.84	1.00	1.00
Heavy Vehicles(%)	6	5	3	5	3	2
Movement Flow Rate	52	244	666	76	75	572
Number of Lanes	1	0	1	1	0	1

Major/Minor			Major 1		Major 2	
Conflicting Flow Rate - All	1426	371	0	0	742	0
Stage 1	704	-	-	-	-	-
Stage 2	722	-	-	-	-	-
Follow-up Headway	3.554	3.345	-	-	2.227	-
Pot Capacity-1 Maneuver	146	668	-	-	861	-
Stage 1	483	-	-	-	-	-
Stage 2	474	-	-	-	-	-
Time blocked-Platoon(%)	0	0	-	-	0	-
Mov Capacity-1 Maneuver	127	668	-	-	861	-
Mov Capacity-2 Maneuver	127	-	-	-	-	-
Stage 1	483	-	-	-	-	-
Stage 2	413	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay (s)	13.4	0	1.1
HCM LOS	B	A	A

Lane	NBT	NBR	WBLn1	SBL	SBT
Capacity (vph)			722		
HCM Control Delay (s)	-	-	13.4	9.58	-
HCM Lane VC Ratio	-	-	0.41	0.087	-
HCM Lane LOS	-	-	B	A	-
HCM 95th Percentile Queue (veh)	-	-	2.008	0.285	-

Intersection	
Intersection Delay (sec/veh):	4.3

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Volume (vph)	117	328	322	95	74	104
Conflicting Peds.(#/hr)	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
Right Turn Channelized	None	None	Yield	Yield	Free	Free
Storage Length	0			0	0	0
Median Width		0	0		12	
Grade (%)		0%	0%		0%	
Peak Hour Factor	0.79	1.00	0.82	0.91	1.00	1.00
Heavy Vehicles(%)	3	2	5	4	3	2
Movement Flow Rate	148	328	393	104	74	104
Number of Lanes	0	1	1	0	1	1

Major/Minor	Major 1		Major 2			
Conflicting Flow Rate - All	497	0	0	0	1069	445
Stage 1	-	-	-	-	445	-
Stage 2	-	-	-	-	624	-
Follow-up Headway	2.227	-	-	-	3.527	3.318
Pot Capacity-1 Maneuver	1062	-	-	-	244	613
Stage 1	-	-	-	-	644	-
Stage 2	-	-	-	-	532	-
Time blocked-Platoon(%)	0	-	-	-	0	0
Mov Capacity-1 Maneuver	1062	-	-	-	203	613
Mov Capacity-2 Maneuver	-	-	-	-	203	-
Stage 1	-	-	-	-	644	-
Stage 2	-	-	-	-	442	-

Approach	EB	WB	SB
HCM Control Delay (s)	2.8	0	20.6
HCM LOS	A	A	C

Lane	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (vph)					203	613
HCM Control Delay (s)	8.938	-	-	-	32.6	12.1
HCM Lane VC Ratio	0.139	-	-	-	0.365	0.17
HCM Lane LOS	A	-	-	-	D	B
HCM 95th Percentile Queue (veh)	0.484	-	-	-	1.568	0.607

Intersection	
Intersection Delay (sec/veh):	0.3

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Volume (vph)	3	391	410	5	3	5
Conflicting Peds.(#/hr)	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
Right Turn Channelized	None	None	None	None	None	None
Storage Length	0			0	0	0
Median Width		0	0		12	
Grade (%)		0%	0%		0%	
Peak Hour Factor	0.75	0.95	0.98	1.00	0.75	0.42
Heavy Vehicles(%)	0	2	4	0	0	0
Movement Flow Rate	4	412	418	5	4	12
Number of Lanes	0	1	1	0	1	0

Major/Minor	Major 1		Major 2			
Conflicting Flow Rate - All	423	0	0	0	841	421
Stage 1	-	-	-	-	421	-
Stage 2	-	-	-	-	420	-
Follow-up Headway	2.2	-	-	-	3.5	3.3
Pot Capacity-1 Maneuver	1147	-	-	-	338	637
Stage 1	-	-	-	-	667	-
Stage 2	-	-	-	-	667	-
Time blocked-Platoon(%)	0	-	-	-	0	0
Mov Capacity-1 Maneuver	1147	-	-	-	336	637
Mov Capacity-2 Maneuver	-	-	-	-	336	-
Stage 1	-	-	-	-	667	-
Stage 2	-	-	-	-	664	-

Approach	EB	WB	SB
HCM Control Delay (s)	0.1	0	12.1
HCM LOS	A	A	B

Lane	EBL	EBT	WBT	WBR	SBLn1
Capacity (vph)					520
HCM Control Delay (s)	8.15	-	-	-	12.1
HCM Lane VC Ratio	0.003	-	-	-	0.031
HCM Lane LOS	A	-	-	-	B
HCM 95th Percentile Queue (veh)	0.01	-	-	-	0.095

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	349	39	72	450	361	411
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0	0	0			450
Storage Lanes	1	1	1			1
Taper Length (ft)	100		100			
Satd. Flow (prot)	1787	1615	1805	1845	1881	1583
Flt Permitted	0.950		0.950			
Satd. Flow (perm)	1787	1615	1805	1845	1881	1583
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)		127				472
Link Speed (mph)	30			30	30	
Link Distance (ft)	220			382	754	
Travel Time (s)	5.0			8.7	17.1	
Peak Hour Factor	0.83	0.70	1.00	1.00	0.95	0.87
Heavy Vehicles (%)	1%	0%	0%	3%	1%	2%
Shared Lane Traffic (%)						
Lane Group Flow (vph)	420	56	72	450	380	472
Turn Type	NA	Perm	Prot	NA	NA	Perm
Protected Phases	3		1	6	2	
Permitted Phases		3				2
Detector Phase	3	3	1	6	2	2
Switch Phase						
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	21.0	21.0	9.0	9.0	21.0	21.0
Total Split (s)	26.0	26.0	9.0	34.0	25.0	25.0
Total Split (%)	43.3%	43.3%	15.0%	56.7%	41.7%	41.7%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag			Lead		Lag	Lag
Lead-Lag Optimize?						
Recall Mode	None	None	None	None	Max	Max
Act Effct Green (s)	16.9	16.9	4.1	25.6	20.8	20.8
Actuated g/C Ratio	0.32	0.32	0.08	0.49	0.39	0.39
v/c Ratio	0.74	0.09	0.51	0.50	0.51	0.52
Control Delay	25.1	0.4	42.6	12.3	17.7	4.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	25.1	0.4	42.6	12.3	17.7	4.2
LOS	C	A	D	B	B	A
Approach Delay	22.2			16.5	10.2	
Approach LOS	C			B	B	
Queue Length 50th (ft)	126	0	25	92	103	0
Queue Length 95th (ft)	190	0	#79	174	191	48
Internal Link Dist (ft)	140			302	674	
Turn Bay Length (ft)						450
Base Capacity (vph)	730	735	140	1041	741	909
Starvation Cap Reductn	0	0	0	0	0	0

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.58	0.08	0.51	0.43	0.51	0.52

Intersection Summary	
Area Type: Other	
Cycle Length: 60	
Actuated Cycle Length: 52.7	
Natural Cycle: 55	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 0.74	
Intersection Signal Delay: 15.1	Intersection LOS: B
Intersection Capacity Utilization 54.8%	ICU Level of Service A
Analysis Period (min) 15	

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 3: J. P. Leong Hwy/Kamehameha Hwy

Intersection	
Intersection Delay (sec/veh):	2.9

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Volume (vph)	46	207	595	77	68	619
Conflicting Peds.(#/hr)	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
Right Turn Channelized	Yield	Yield	Yield	Yield	None	None
Storage Length	0	0		200	0	
Median Width	12		0			0
Grade (%)	0%		0%			0%
Peak Hour Factor	1.00	1.00	0.91	0.80	0.77	0.92
Heavy Vehicles(%)	7	2	2	6	4	3
Movement Flow Rate	46	207	654	96	88	673
Number of Lanes	1	0	1	1	0	1

Major/Minor			Major 1		Major 2	
Conflicting Flow Rate - All	1551	375	0	0	750	0
Stage 1	702	-	-	-	-	-
Stage 2	849	-	-	-	-	-
Follow-up Headway	3.563	3.318	-	-	2.236	-
Pot Capacity-1 Maneuver	122	671	-	-	850	-
Stage 1	482	-	-	-	-	-
Stage 2	411	-	-	-	-	-
Time blocked-Platoon(%)	0	0	-	-	0	-
Mov Capacity-1 Maneuver	102	671	-	-	850	-
Mov Capacity-2 Maneuver	102	-	-	-	-	-
Stage 1	482	-	-	-	-	-
Stage 2	343	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay (s)	16.6	0	1.1
HCM LOS	C	A	A

Lane	NBT	NBR	WBLn1	SBL	SBT
Capacity (vph)			561		
HCM Control Delay (s)	-	-	16.6	9.726	-
HCM Lane VC Ratio	-	-	0.451	0.104	-
HCM Lane LOS	-	-	C	A	-
HCM 95th Percentile Queue (veh)	-	-	2.324	0.347	-

HCS+: Two-Lane Highways Release 5.4

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Two-Way Two-Lane Highway Segment Analysis

Analyst	RSO
Agency/Co.	Traffic Management Consultant
Date Performed	11/3/11
Analysis Time Period	AM Peak Hour of Traffic
Highway	Kamehameha Highway
From/To	West of Kuilima Drive
Jurisdiction	
Analysis Year	Existing
Description Turtle Bay	Resort Master Plan

Input Data

Highway class	Class 1				
Shoulder width	6.0	ft	Peak-hour factor, PHF	0.94	
Lane width	12.0	ft	% Trucks and buses	8	%
Segment length	0.0	mi	% Recreational vehicles	0	%
Terrain type	Level		% No-passing zones	50	%
Grade: Length		mi	Access points/mi	2	/mi
Up/down		%			

Two-way hourly volume, V	517	veh/h		
Directional split	51 / 49	%		

Average Travel Speed

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.7	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor,	0.947	
Two-way flow rate,(note-1) vp	581	pc/h
Highest directional split proportion (note-2)	296	pc/h

Free-Flow Speed from Field Measurement:		
Field measured speed, SFM	-	mi/h
Observed volume, Vf	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed, BFFS	45.0	mi/h
Adj. for lane and shoulder width, fLS	0.0	mi/h
Adj. for access points, fA	0.5	mi/h
Free-flow speed, FFS	44.5	mi/h

Adjustment for no-passing zones, fnp	2.7	mi/h
Average travel speed, ATS	37.3	mi/h

Percent Time-Spent-Following

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.1	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor, fHV	0.992	
Two-way flow rate,(note-1) vp	554	pc/h
Highest directional split proportion (note-2)	283	
Base percent time-spent-following, BPTSF	38.6	%
Adj.for directional distribution and no-passing zones, fd/np	18.1	
Percent time-spent-following, PTSF	56.6	%

Level of Service and Other Performance Measures

Level of service, LOS	E	
Volume to capacity ratio, v/c	0.18	
Peak 15-min vehicle-miles of travel, VMT15	0	veh-mi
Peak-hour vehicle-miles of travel, VMT60	0	veh-mi
Peak 15-min total travel time, TT15	0.0	veh-h

Notes:
1. If vp >= 3200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split vp >= 1700 pc/h, terminate analysis-the LOS is F.

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Two-Way Two-Lane Highway Segment Analysis

Analyst	RSO
Agency/Co.	Traffic Management Consultant
Date Performed	11/1/2011
Analysis Time Period	AM Peak Hour of Traffic
Highway	Kamehameha Highway
From/To	Haleiwa to Kawailoa
Jurisdiction	
Analysis Year	Existing
Description	Turtle Bay Resort Master Plan

Input Data

Highway class	Class 1				
Shoulder width	6.0	ft	Peak-hour factor, PHF	0.94	
Lane width	12.0	ft	% Trucks and buses	4	%
Segment length	0.0	mi	% Recreational vehicles	0	%
Terrain type	Level		% No-passing zones	80	%
Grade: Length		mi	Access points/mi	2	/mi
Up/down		%			

Two-way hourly volume, V	1059	veh/h	
Directional split	51 / 49	%	

Average Travel Speed

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.2	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor,	0.992	
Two-way flow rate,(note-1) vp	1136	pc/h
Highest directional split proportion (note-2)	579	pc/h
Free-Flow Speed from Field Measurement:		
Field measured speed, SFM	-	mi/h
Observed volume, Vf	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed, BFFS	45.0	mi/h
Adj. for lane and shoulder width, fLS	0.0	mi/h
Adj. for access points, fA	0.5	mi/h
Free-flow speed, FFS	44.5	mi/h
Adjustment for no-passing zones, fnp	2.0	mi/h

Average travel speed, ATS 33.7 mi/h

Percent Time-Spent-Following

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.1	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor, fHV	0.996	
Two-way flow rate,(note-1) vp	1131	pc/h
Highest directional split proportion (note-2)	577	
Base percent time-spent-following, BPTSF	63.0	%
Adj.for directional distribution and no-passing zones, fd/np	10.5	
Percent time-spent-following, PTSF	73.5	%

Level of Service and Other Performance Measures

Level of service, LOS	E	
Volume to capacity ratio, v/c	0.35	
Peak 15-min vehicle-miles of travel, VMT15	0	veh-mi
Peak-hour vehicle-miles of travel, VMT60	0	veh-mi
Peak 15-min total travel time, TT15	0.0	veh-h

Notes:
1. If vp >= 3200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split vp >= 1700 pc/h, terminate analysis-the LOS is F.

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Two-Way Two-Lane Highway Segment Analysis

Analyst	RSO
Agency/Co.	Traffic Management Consultant
Date Performed	11/1/2011
Analysis Time Period	AM Peak Hour of Traffic
Highway	Kamehameha Highway
From/To	Hygienic Store
Jurisdiction	
Analysis Year	Existing
Description Turtle Bay	Resort Master Plan

Input Data

Highway class Class 1					
Shoulder width	6.0	ft	Peak-hour factor, PHF	0.89	
Lane width	12.0	ft	% Trucks and buses	3	%
Segment length	0.0	mi	% Recreational vehicles	0	%
Terrain type	Level		% No-passing zones	80	%
Grade: Length		mi	Access points/mi	10	/mi
Up/down		%			

Two-way hourly volume, V	1178	veh/h	
Directional split	67 / 33	%	

Average Travel Speed

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.1	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor,	0.997	
Two-way flow rate,(note-1) vp	1328	pc/h
Highest directional split proportion (note-2)	890	pc/h
Free-Flow Speed from Field Measurement:		
Field measured speed, SFM	-	mi/h
Observed volume, Vf	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed, BFFS	45.0	mi/h
Adj. for lane and shoulder width, fLS	0.0	mi/h
Adj. for access points, fA	2.5	mi/h
Free-flow speed, FFS	42.5	mi/h
Adjustment for no-passing zones, fnp	1.6	mi/h

Average travel speed, ATS 30.6 mi/h

Percent Time-Spent-Following

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.0	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor, fHV	1.000	
Two-way flow rate,(note-1) vp	1324	pc/h
Highest directional split proportion (note-2)	887	
Base percent time-spent-following, BPTSF	68.8	%
Adj.for directional distribution and no-passing zones, fd/np	8.6	
Percent time-spent-following, PTSF	77.4	%

Level of Service and Other Performance Measures

Level of service, LOS	E	
Volume to capacity ratio, v/c	0.41	
Peak 15-min vehicle-miles of travel, VMT15	0	veh-mi
Peak-hour vehicle-miles of travel, VMT60	0	veh-mi
Peak 15-min total travel time, TT15	0.0	veh-h

Notes:
1. If vp >= 3200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split vp >= 1700 pc/h, terminate analysis-the LOS is F.

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Two-Way Two-Lane Highway Segment Analysis

Analyst	RSO
Agency/Co.	Traffic Management Consultant
Date Performed	11/3/11
Analysis Time Period	PM Peak Hour of Traffic
Highway	Kamehameha Highway
From/To	West of Kuilima Drive
Jurisdiction	
Analysis Year	Existing
Description Turtle Bay	Resort Master Plan

Input Data

Highway class Class 1					
Shoulder width	6.0	ft	Peak-hour factor, PHF	0.87	
Lane width	12.0	ft	% Trucks and buses	4	%
Segment length	0.0	mi	% Recreational vehicles	0	%
Terrain type	Level		% No-passing zones	50	%
Grade: Length		mi	Access points/mi	2	/mi
Up/down		%			

Two-way hourly volume, V	728	veh/h		
Directional split	50 / 50	%		

Average Travel Speed

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.2	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor,	0.992	
Two-way flow rate,(note-1) vp	843	pc/h
Highest directional split proportion (note-2)	422	pc/h
Free-Flow Speed from Field Measurement:		
Field measured speed, SFM	-	mi/h
Observed volume, Vf	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed, BFFS	45.0	mi/h
Adj. for lane and shoulder width, fLS	0.0	mi/h
Adj. for access points, fA	0.5	mi/h
Free-flow speed, FFS	44.5	mi/h
Adjustment for no-passing zones, fnp	2.1	mi/h

Average travel speed, ATS 35.9 mi/h

Percent Time-Spent-Following

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.1	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor, fHV	0.996	
Two-way flow rate,(note-1) vp	840	pc/h
Highest directional split proportion (note-2)	420	
Base percent time-spent-following, BPTSF	52.2	%
Adj.for directional distribution and no-passing zones, fd/np	12.7	
Percent time-spent-following, PTSF	64.9	%

Level of Service and Other Performance Measures

Level of service, LOS	E	
Volume to capacity ratio, v/c	0.26	
Peak 15-min vehicle-miles of travel, VMT15	0	veh-mi
Peak-hour vehicle-miles of travel, VMT60	0	veh-mi
Peak 15-min total travel time, TT15	0.0	veh-h

Notes:
1. If vp >= 3200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split vp >= 1700 pc/h, terminate analysis-the LOS is F.

HCS+: Two-Lane Highways Release 5.4

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Two-Way Two-Lane Highway Segment Analysis

Analyst	RSO
Agency/Co.	Traffic Management Consultant
Date Performed	11/1/2011
Analysis Time Period	PM Peak Hour of Traffic
Highway	Kamehameha Highway
From/To	Haleiwa to Kawailoa
Jurisdiction	
Analysis Year	Existing
Description	Turtle Bay Resort Master Plan

Input Data

Highway class	Class 1				
Shoulder width	6.0	ft	Peak-hour factor, PHF	0.95	
Lane width	12.0	ft	% Trucks and buses	2	%
Segment length	0.0	mi	% Recreational vehicles	0	%
Terrain type	Level		% No-passing zones	80	%
Grade: Length		mi	Access points/mi	2	/mi
Up/down		%			

Two-way hourly volume, V	1443	veh/h	
Directional split	51 / 49	%	

Average Travel Speed

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.1	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor,	0.998	
Two-way flow rate,(note-1) vp	1522	pc/h
Highest directional split proportion (note-2)	776	pc/h
Free-Flow Speed from Field Measurement:		
Field measured speed, SFM	-	mi/h
Observed volume, Vf	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed, BFFS	45.0	mi/h
Adj. for lane and shoulder width, fLS	0.0	mi/h
Adj. for access points, fA	0.5	mi/h
Free-flow speed, FFS	44.5	mi/h
Adjustment for no-passing zones, fnp	1.3	mi/h

Average travel speed, ATS 31.4 mi/h

Percent Time-Spent-Following

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.0	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor, fHV	1.000	
Two-way flow rate,(note-1) vp	1519	pc/h
Highest directional split proportion (note-2)	775	
Base percent time-spent-following, BPTSF	73.7	%
Adj.for directional distribution and no-passing zones, fd/np	6.7	
Percent time-spent-following, PTSF	80.4	%

Level of Service and Other Performance Measures

Level of service, LOS	E	
Volume to capacity ratio, v/c	0.48	
Peak 15-min vehicle-miles of travel, VMT15	0	veh-mi
Peak-hour vehicle-miles of travel, VMT60	0	veh-mi
Peak 15-min total travel time, TT15	0.0	veh-h

Notes:
1. If vp >= 3200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split vp >= 1700 pc/h, terminate analysis-the LOS is F.

HCS+: Two-Lane Highways Release 5.4

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Two-Way Two-Lane Highway Segment Analysis

Analyst	RSO
Agency/Co.	Traffic Management Consultant
Date Performed	11/1/2011
Analysis Time Period	PM Peak Hour of Traffic
Highway	Kamehameha Highway
From/To	Hygienic Store
Jurisdiction	
Analysis Year	Existing
Description	Turtle Bay Resort Master Plan

Input Data

Highway class	Class 1				
Shoulder width	6.0	ft	Peak-hour factor, PHF	0.99	
Lane width	12.0	ft	% Trucks and buses	5	%
Segment length	0.0	mi	% Recreational vehicles	0	%
Terrain type	Level		% No-passing zones	80	%
Grade: Length		mi	Access points/mi	10	/mi
Up/down		%			

Two-way hourly volume, V	1519	veh/h	
Directional split	57 / 43	%	

Average Travel Speed

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.1	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor,	0.995	
Two-way flow rate,(note-1) vp	1542	pc/h
Highest directional split proportion (note-2)	879	pc/h
Free-Flow Speed from Field Measurement:		
Field measured speed, SFM	-	mi/h
Observed volume, Vf	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed, BFFS	45.0	mi/h
Adj. for lane and shoulder width, fLS	0.0	mi/h
Adj. for access points, fA	2.5	mi/h
Free-flow speed, FFS	42.5	mi/h
Adjustment for no-passing zones, fnp	1.3	mi/h

Average travel speed, ATS 29.2 mi/h

Percent Time-Spent-Following

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.0	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor, fHV	1.000	
Two-way flow rate,(note-1) vp	1534	pc/h
Highest directional split proportion (note-2)	874	
Base percent time-spent-following, BPTSF	74.0	%
Adj.for directional distribution and no-passing zones, fd/np	6.7	
Percent time-spent-following, PTSF	80.8	%

Level of Service and Other Performance Measures

Level of service, LOS	E	
Volume to capacity ratio, v/c	0.48	
Peak 15-min vehicle-miles of travel, VMT15	0	veh-mi
Peak-hour vehicle-miles of travel, VMT60	0	veh-mi
Peak 15-min total travel time, TT15	0.0	veh-h

Notes:
1. If vp >= 3200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split vp >= 1700 pc/h, terminate analysis-the LOS is F.

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Two-Way Two-Lane Highway Segment Analysis

Analyst	RSO
Agency/Co.	Traffic Management Consultant
Date Performed	11/5/11
Analysis Time Period	Saturday Peak Hour of Traffic
Highway	Kamehameha Highway
From/To	West of Kuilima Drive
Jurisdiction	
Analysis Year	Existing
Description	Turtle Bay Resort Master Plan

Input Data

Highway class	Class 1				
Shoulder width	6.0	ft	Peak-hour factor, PHF	0.94	
Lane width	12.0	ft	% Trucks and buses	3	%
Segment length	0.0	mi	% Recreational vehicles	0	%
Terrain type	Level		% No-passing zones	50	%
Grade: Length		mi	Access points/mi	2	/mi
Up/down		%			

Two-way hourly volume, V	867	veh/h	
Directional split	51 / 49	%	

Average Travel Speed

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.2	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor,	0.994	
Two-way flow rate,(note-1) vp	928	pc/h
Highest directional split proportion (note-2)	473	pc/h
Free-Flow Speed from Field Measurement:		
Field measured speed, SFM	-	mi/h
Observed volume, Vf	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed, BFFS	45.0	mi/h
Adj. for lane and shoulder width, fLS	0.0	mi/h
Adj. for access points, fA	0.5	mi/h
Free-flow speed, FFS	44.5	mi/h
Adjustment for no-passing zones, fnp	1.9	mi/h

Average travel speed, ATS 35.4 mi/h

Percent Time-Spent-Following

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.1	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor, fHV	0.997	
Two-way flow rate,(note-1) vp	925	pc/h
Highest directional split proportion (note-2)	472	
Base percent time-spent-following, BPTSF	55.7	%
Adj.for directional distribution and no-passing zones, fd/np	11.6	
Percent time-spent-following, PTSF	67.3	%

Level of Service and Other Performance Measures

Level of service, LOS	E	
Volume to capacity ratio, v/c	0.29	
Peak 15-min vehicle-miles of travel, VMT15	0	veh-mi
Peak-hour vehicle-miles of travel, VMT60	0	veh-mi
Peak 15-min total travel time, TT15	0.0	veh-h

Notes:
1. If vp >= 3200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split vp >= 1700 pc/h, terminate analysis-the LOS is F.

HCS+: Two-Lane Highways Release 5.4

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Two-Way Two-Lane Highway Segment Analysis

Analyst	RSO
Agency/Co.	Traffic Management Consultant
Date Performed	10/29/2011
Analysis Time Period	Saturday Peak Hour of Traffic
Highway	Kamehameha Highway
From/To	Haleiwa to Kawailoa
Jurisdiction	
Analysis Year	Existing
Description	Turtle Bay Resort Master Plan

Input Data

Highway class	Class 1				
Shoulder width	6.0	ft	Peak-hour factor, PHF	0.92	
Lane width	12.0	ft	% Trucks and buses	2	%
Segment length	0.0	mi	% Recreational vehicles	0	%
Terrain type	Level		% No-passing zones	80	%
Grade: Length		mi	Access points/mi	2	/mi
Up/down		%			

Two-way hourly volume, V	1571	veh/h	
Directional split	51 / 49	%	

Average Travel Speed

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.1	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor,	0.998	
Two-way flow rate,(note-1) vp	1711	pc/h
Highest directional split proportion (note-2)	873	pc/h
Free-Flow Speed from Field Measurement:		
Field measured speed, SFM	-	mi/h
Observed volume, Vf	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed, BFFS	45.0	mi/h
Adj. for lane and shoulder width, fLS	0.0	mi/h
Adj. for access points, fA	0.5	mi/h
Free-flow speed, FFS	44.5	mi/h
Adjustment for no-passing zones, fnp	1.2	mi/h

Average travel speed, ATS 30.0 mi/h

Percent Time-Spent-Following

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.0	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor, fHV	1.000	
Two-way flow rate,(note-1) vp	1708	pc/h
Highest directional split proportion (note-2)	871	
Base percent time-spent-following, BPTSF	77.7	%
Adj.for directional distribution and no-passing zones, fd/np	5.7	
Percent time-spent-following, PTSF	83.4	%

Level of Service and Other Performance Measures

Level of service, LOS	E	
Volume to capacity ratio, v/c	0.53	
Peak 15-min vehicle-miles of travel, VMT15	0	veh-mi
Peak-hour vehicle-miles of travel, VMT60	0	veh-mi
Peak 15-min total travel time, TT15	0.0	veh-h

Notes:
1. If vp >= 3200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split vp >= 1700 pc/h, terminate analysis-the LOS is F.

HCS+: Two-Lane Highways Release 5.4

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Two-Way Two-Lane Highway Segment Analysis

Analyst	RSO
Agency/Co.	Traffic Management Consultant
Date Performed	10/29/2011
Analysis Time Period	Saturday Peak Hour of Traffic
Highway	Kamehameha Highway
From/To	Hygienic Store
Jurisdiction	
Analysis Year	Existing
Description	Turtle Bay Resort Master Plan

Input Data

Highway class	Class 1				
Shoulder width	6.0	ft	Peak-hour factor, PHF	0.94	
Lane width	12.0	ft	% Trucks and buses	3	%
Segment length	0.0	mi	% Recreational vehicles	0	%
Terrain type	Level		% No-passing zones	80	%
Grade: Length		mi	Access points/mi	10	/mi
Up/down		%			

Two-way hourly volume, V	1489	veh/h	
Directional split	54 / 46	%	

Average Travel Speed

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.1	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor,	0.997	
Two-way flow rate,(note-1) vp	1589	pc/h
Highest directional split proportion (note-2)	858	pc/h
Free-Flow Speed from Field Measurement:		
Field measured speed, SFM	-	mi/h
Observed volume, Vf	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed, BFFS	45.0	mi/h
Adj. for lane and shoulder width, fLS	0.0	mi/h
Adj. for access points, fA	2.5	mi/h
Free-flow speed, FFS	42.5	mi/h
Adjustment for no-passing zones, fnp	1.3	mi/h

Average travel speed, ATS 28.9 mi/h

Percent Time-Spent-Following

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.0	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor, fHV	1.000	
Two-way flow rate,(note-1) vp	1584	pc/h
Highest directional split proportion (note-2)	855	
Base percent time-spent-following, BPTSF	75.2	%
Adj.for directional distribution and no-passing zones, fd/np	6.4	
Percent time-spent-following, PTSF	81.5	%

Level of Service and Other Performance Measures

Level of service, LOS	E	
Volume to capacity ratio, v/c	0.50	
Peak 15-min vehicle-miles of travel, VMT15	0	veh-mi
Peak-hour vehicle-miles of travel, VMT60	0	veh-mi
Peak 15-min total travel time, TT15	0.0	veh-h

Notes:
1. If vp >= 3200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split vp >= 1700 pc/h, terminate analysis-the LOS is F.

TRAFFIC IMPACT ANALYSIS REPORT

FOR THE PROPOSED

TURTLE BAY RESORT MASTER PLAN

KAHUKU, OAHU, HAWAII

APPENDIX C

CAPACITY ANALYSIS WORKSHEETS

2025 TRAFFIC CONDITIONS WITHOUT PROJECT

Intersection	
Intersection Delay (sec/veh):	4.2

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Volume (vph)	95	219	228	68	81	98
Conflicting Peds.(#/hr)	1	0	0	1	7	0
Sign Control	Free	Free	Free	Free	Stop	Stop
Right Turn Channelized	None	None	Yield	Yield	Free	Free
Storage Length	0			0	0	0
Median Width		0	0		12	
Grade (%)		0%	0%		0%	
Peak Hour Factor	0.88	0.79	1.00	0.94	0.92	0.98
Heavy Vehicles(%)	4	13	6	7	6	7
Movement Flow Rate	108	277	228	72	88	100
Number of Lanes	0	1	1	0	1	1

Major/Minor	Major 1		Major 2			
Conflicting Flow Rate - All	307	0	0	0	764	272
Stage 1	-	-	-	-	271	-
Stage 2	-	-	-	-	493	-
Follow-up Headway	2.236	-	-	-	3.554	3.363
Pot Capacity-1 Maneuver	1242	-	-	-	366	755
Stage 1	-	-	-	-	765	-
Stage 2	-	-	-	-	606	-
Time blocked-Platoon(%)	0	-	-	-	0	0
Mov Capacity-1 Maneuver	1241	-	-	-	324	750
Mov Capacity-2 Maneuver	-	-	-	-	324	-
Stage 1	-	-	-	-	761	-
Stage 2	-	-	-	-	540	-

Approach	EB	WB	SB
HCM Control Delay (s)	2.3	0	15
HCM LOS	A	A	C

Lane	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (vph)					324	750
HCM Control Delay (s)	8.177	-	-	-	20.2	10.5
HCM Lane VC Ratio	0.087	-	-	-	0.272	0.133
HCM Lane LOS	A	-	-	-	C	B
HCM 95th Percentile Queue (veh)	0.285	-	-	-	1.08	0.459

Intersection	
Intersection Delay (sec/veh):	1.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume (vph)	1	282	17	19	268	6	24	0	18	6	0	4
Conflicting Peds.(#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
Right Turn Channelized	None	None	None	None	None	None	None	None	None	None	None	None
Storage Length	0		0	330		0	0		0	0		0
Median Width		12			12			0			0	
Grade (%)		0%			0%			0%			0%	
Peak Hour Factor	1.00	0.82	0.92	0.92	0.87	1.00	0.92	0.92	0.92	1.00	0.92	1.00
Heavy Vehicles(%)	0	13	50	50	6	0	50	5	50	0	5	0
Movement Flow Rate	1	344	18	21	308	6	26	0	20	6	0	4
Number of Lanes	0	1	0	1	1	0	0	1	0	0	1	0

Major/Minor	Major 1			Major 2			Minor 1			Minor 2		
Conflicting Flow Rate - All	314	0	0	362	0	0	710	711	353	718	717	157
Stage 1	-	-	-	-	-	-	355	355	-	353	353	-
Stage 2	-	-	-	-	-	-	355	356	-	365	364	-
Follow-up Headway	2.2	-	-	2.65	-	-	3.95	4.045	3.75	3.5	4.045	3.3
Pot Capacity-1 Maneuver	1258	-	-	974	-	-	293	354	595	347	352	894
Stage 1	-	-	-	-	-	-	574	624	-	668	626	-
Stage 2	-	-	-	-	-	-	574	624	-	658	619	-
Time blocked-Platoon(%)	0	-	-	0	-	-	0	0	0	0	0	0
Mov Capacity-1 Maneuver	1258	-	-	974	-	-	287	346	595	330	344	894
Mov Capacity-2 Maneuver	-	-	-	-	-	-	287	346	-	330	344	-
Stage 1	-	-	-	-	-	-	573	623	-	667	613	-
Stage 2	-	-	-	-	-	-	559	611	-	636	618	-

Approach	EB	WB	NB	SB
HCM Control Delay (s)	0	0.5	16.1	13.4
HCM LOS	A	A	C	B

Lane	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (vph)	369							441
HCM Control Delay (s)	16.1	7.864	0	-	8.776	0	-	13.4
HCM Lane VC Ratio	0.124	0.001	-	-	0.021	-	-	0.023
HCM Lane LOS	C	A	A	-	A	A	-	B
HCM 95th Percentile Queue (veh)	0.419	0.002	-	-	0.065	-	-	0.07

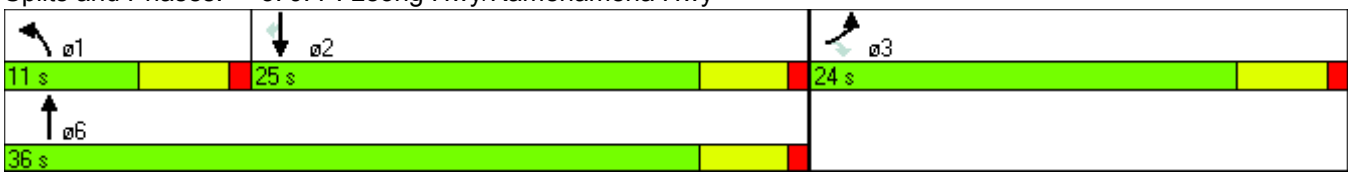
Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	270	27	44	284	251	337
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0	0	0			450
Storage Lanes	1	1	1			1
Taper Length (ft)	100		100			
Satd. Flow (prot)	1719	1615	1805	1792	1845	1568
Flt Permitted	0.950		0.950			
Satd. Flow (perm)	1719	1615	1805	1792	1845	1568
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)		127				362
Link Speed (mph)	30			30	30	
Link Distance (ft)	220			382	754	
Travel Time (s)	5.0			8.7	17.1	
Peak Hour Factor	0.87	1.00	0.61	0.97	1.00	0.93
Heavy Vehicles (%)	5%	0%	0%	6%	3%	3%
Shared Lane Traffic (%)						
Lane Group Flow (vph)	310	27	72	293	251	362
Turn Type	NA	Perm	Prot	NA	NA	Perm
Protected Phases	3		1	6	2	
Permitted Phases		3				2
Detector Phase	3	3	1	6	2	2
Switch Phase						
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	21.0	21.0	9.0	9.0	21.0	21.0
Total Split (s)	24.0	24.0	11.0	36.0	25.0	25.0
Total Split (%)	40.0%	40.0%	18.3%	60.0%	41.7%	41.7%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag			Lead		Lag	Lag
Lead-Lag Optimize?						
Recall Mode	None	None	None	None	Max	Max
Act Effct Green (s)	14.1	14.1	6.0	28.2	22.2	22.2
Actuated g/C Ratio	0.27	0.27	0.11	0.54	0.42	0.42
v/c Ratio	0.67	0.05	0.35	0.30	0.32	0.42
Control Delay	25.4	0.2	29.2	8.5	14.6	3.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	25.4	0.2	29.2	8.5	14.6	3.7
LOS	C	A	C	A	B	A
Approach Delay	23.4			12.6	8.2	
Approach LOS	C			B	A	
Queue Length 50th (ft)	92	0	23	46	61	0
Queue Length 95th (ft)	155	0	39	99	124	49
Internal Link Dist (ft)	140			302	674	
Turn Bay Length (ft)						450
Base Capacity (vph)	636	678	211	1082	781	872
Starvation Cap Reductn	0	0	0	0	0	0

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.49	0.04	0.34	0.27	0.32	0.42

Intersection Summary

Area Type: Other
Cycle Length: 60
Actuated Cycle Length: 52.5
Natural Cycle: 55
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.67
Intersection Signal Delay: 13.3 Intersection LOS: B
Intersection Capacity Utilization 44.0% ICU Level of Service A
Analysis Period (min) 15

Splits and Phases: 3: J. P. Leong Hwy/Kamehameha Hwy



Intersection	
Intersection Delay (sec/veh):	$ 473

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Volume (vph)	42	101	386	152	512	456
Conflicting Peds.(#/hr)	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
Right Turn Channelized	Yield	Yield	Yield	Yield	None	None
Storage Length	0	0		200	0	
Median Width	12		0			0
Grade (%)	0%		0%			0%
Peak Hour Factor	0.75	0.84	0.98	0.83	0.77	1.00
Heavy Vehicles(%)	6	7	5	4	2	3
Movement Flow Rate	56	120	394	183	665	456
Number of Lanes	1	0	1	1	0	1

Major/Minor			Major 1			Major 2
Conflicting Flow Rate - All	2272	289	0	0	577	0
Stage 1	486	-	-	-	-	-
Stage 2	1786	-	-	-	-	-
Follow-up Headway	3.554	3.363	-	-	2.218	-
Pot Capacity-1 Maneuver	# 43	738	-	-	996	-
Stage 1	610	-	-	-	-	-
Stage 2	144	-	-	-	-	-
Time blocked-Platoon(%)	0	0	-	-	0	-
Mov Capacity-1 Maneuver	# 5	738	-	-	996	-
Mov Capacity-2 Maneuver	# 5	-	-	-	-	-
Stage 1	610	-	-	-	-	-
Stage 2	# 15	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay (s)	$ 4971.9	0	9.2
HCM LOS	F	A	A

Lane	NBT	NBR	WBLn1	SBL	SBT
Capacity (vph)			16		
HCM Control Delay (s)	-	-	$ 4971.9	15.552	-
HCM Lane VC Ratio	-	-	11.015	0.668	-
HCM Lane LOS	-	-	F	C	-
HCM 95th Percentile Queue (veh)	-	-	22.914	5.337	-

Intersection	
Intersection Delay (sec/veh):	4.4

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Volume (vph)	118	320	347	108	75	111
Conflicting Peds.(#/hr)	0	0	0	0	3	1
Sign Control	Free	Free	Free	Free	Stop	Stop
Right Turn Channelized	None	None	Yield	Yield	Free	Free
Storage Length	0			0	0	0
Median Width		0	0		12	
Grade (%)		0%	0%		0%	
Peak Hour Factor	0.92	0.80	0.85	0.87	0.99	0.90
Heavy Vehicles(%)	2	3	5	8	4	7
Movement Flow Rate	128	400	408	124	76	123
Number of Lanes	0	1	1	0	1	1

Major/Minor	Major 1		Major 2			
Conflicting Flow Rate - All	535	0	0	0	1129	473
Stage 1	-	-	-	-	473	-
Stage 2	-	-	-	-	656	-
Follow-up Headway	2.218	-	-	-	3.536	3.363
Pot Capacity-1 Maneuver	1033	-	-	-	224	581
Stage 1	-	-	-	-	623	-
Stage 2	-	-	-	-	513	-
Time blocked-Platoon(%)	0	-	-	-	0	0
Mov Capacity-1 Maneuver	1033	-	-	-	187	580
Mov Capacity-2 Maneuver	-	-	-	-	187	-
Stage 1	-	-	-	-	621	-
Stage 2	-	-	-	-	430	-

Approach	EB	WB	SB
HCM Control Delay (s)	2.2	0	22
HCM LOS	A	A	C

Lane	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (vph)					187	580
HCM Control Delay (s)	8.978	-	-	-	36.8	12.9
HCM Lane VC Ratio	0.124	-	-	-	0.405	0.213
HCM Lane LOS	A	-	-	-	E	B
HCM 95th Percentile Queue (veh)	0.424	-	-	-	1.808	0.799

Intersection	
Intersection Delay (sec/veh):	1.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume (vph)	2	369	24	28	428	7	24	0	20	7	0	3
Conflicting Peds.(#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
Right Turn Channelized	None	None	None	None	None	None	None	None	None	None	None	None
Storage Length	0		0	330		0	0		0	0		0
Median Width		12			12			0			0	
Grade (%)		0%			0%			0%			0%	
Peak Hour Factor	0.25	0.86	0.92	0.92	0.90	1.00	0.92	0.92	0.92	1.00	0.92	0.75
Heavy Vehicles(%)	0	3	50	50	5	0	50	5	50	0	5	0
Movement Flow Rate	8	429	26	30	476	7	26	0	22	7	0	4
Number of Lanes	0	1	0	1	1	0	0	1	0	0	1	0

Major/Minor	Major 1			Major 2			Minor 1			Minor 2		
Conflicting Flow Rate - All	483	0	0	455	0	0	1000	1001	442	1009	1011	242
Stage 1	-	-	-	-	-	-	458	458	-	540	540	-
Stage 2	-	-	-	-	-	-	542	543	-	469	471	-
Follow-up Headway	2.2	-	-	2.65	-	-	3.95	4.045	3.75	3.5	4.045	3.3
Pot Capacity-1 Maneuver	1090	-	-	894	-	-	182	240	526	221	237	802
Stage 1	-	-	-	-	-	-	501	562	-	530	517	-
Stage 2	-	-	-	-	-	-	448	515	-	579	554	-
Time blocked-Platoon(%)	0	-	-	0	-	-	0	0	0	0	0	0
Mov Capacity-1 Maneuver	1090	-	-	894	-	-	175	230	526	205	227	802
Mov Capacity-2 Maneuver	-	-	-	-	-	-	175	230	-	205	227	-
Stage 1	-	-	-	-	-	-	496	556	-	525	500	-
Stage 2	-	-	-	-	-	-	431	498	-	550	548	-

Approach	EB	WB	NB	SB
HCM Control Delay (s)	0.1	0.5	22.7	18.3
HCM LOS	A	A	C	C

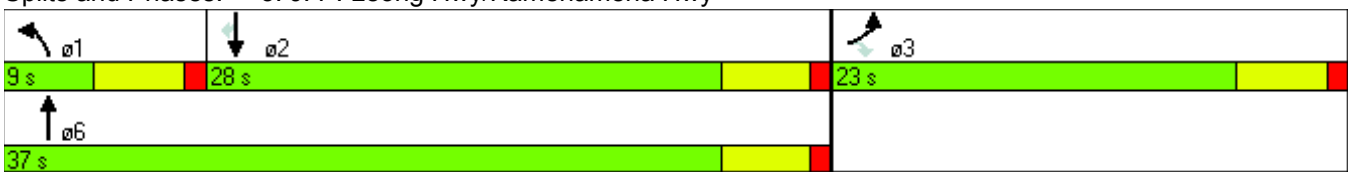
Lane	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (vph)	251							281
HCM Control Delay (s)	22.7	8.327	0	-	9.169	0	-	18.3
HCM Lane VC Ratio	0.191	0.007	-	-	0.034	-	-	0.039
HCM Lane LOS	C	A	A	-	A	A	-	C
HCM 95th Percentile Queue (veh)	0.688	0.022	-	-	0.106	-	-	0.122

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	344	18	43	415	379	410
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0	0	0			450
Storage Lanes	1	1	1			1
Taper Length (ft)	100		100			
Satd. Flow (prot)	1787	1615	1805	1900	1810	1583
Flt Permitted	0.950		0.950			
Satd. Flow (perm)	1787	1615	1805	1900	1810	1583
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)		127				423
Link Speed (mph)	30			30	30	
Link Distance (ft)	220			382	754	
Travel Time (s)	5.0			8.7	17.1	
Peak Hour Factor	0.98	1.00	1.00	1.00	0.85	0.97
Heavy Vehicles (%)	1%	0%	0%	0%	5%	2%
Shared Lane Traffic (%)						
Lane Group Flow (vph)	351	18	43	415	446	423
Turn Type	NA	Perm	Prot	NA	NA	Perm
Protected Phases	3		1	6	2	
Permitted Phases		3				2
Detector Phase	3	3	1	6	2	2
Switch Phase						
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	21.0	21.0	9.0	9.0	21.0	21.0
Total Split (s)	23.0	23.0	9.0	37.0	28.0	28.0
Total Split (%)	38.3%	38.3%	15.0%	61.7%	46.7%	46.7%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag			Lead		Lag	Lag
Lead-Lag Optimize?						
Recall Mode	None	None	None	None	Max	Max
Act Effct Green (s)	14.2	14.2	4.1	27.5	24.4	24.4
Actuated g/C Ratio	0.27	0.27	0.08	0.53	0.47	0.47
v/c Ratio	0.72	0.03	0.30	0.41	0.52	0.44
Control Delay	26.6	0.1	31.2	9.4	14.7	3.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	26.6	0.1	31.2	9.4	14.7	3.3
LOS	C	A	C	A	B	A
Approach Delay	25.3			11.4	9.2	
Approach LOS	C			B	A	
Queue Length 50th (ft)	82	0	11	67	74	0
Queue Length 95th (ft)	189	0	42	137	197	48
Internal Link Dist (ft)	140			302	674	
Turn Bay Length (ft)						450
Base Capacity (vph)	631	652	141	1193	851	968
Starvation Cap Reductn	0	0	0	0	0	0

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.56	0.03	0.30	0.35	0.52	0.44

Intersection Summary	
Area Type: Other	
Cycle Length: 60	
Actuated Cycle Length: 51.8	
Natural Cycle: 60	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 0.72	
Intersection Signal Delay: 13.3	Intersection LOS: B
Intersection Capacity Utilization 54.8%	ICU Level of Service A
Analysis Period (min) 15	

Splits and Phases: 3: J. P. Leong Hwy/Kamehameha Hwy



Intersection	
Intersection Delay (sec/veh):	13.7

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Volume (vph)	61	296	782	77	93	706
Conflicting Peds.(#/hr)	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
Right Turn Channelized	Yield	Yield	Yield	Yield	None	None
Storage Length	0	0		200	0	
Median Width	12		0			0
Grade (%)	0%		0%			0%
Peak Hour Factor	0.95	0.99	0.95	0.84	1.00	1.00
Heavy Vehicles(%)	6	5	3	5	3	2
Movement Flow Rate	64	299	823	92	93	706
Number of Lanes	1	0	1	1	0	1

Major/Minor			Major 1			Major 2
Conflicting Flow Rate - All	1761	458	0	0	915	0
Stage 1	869	-	-	-	-	-
Stage 2	892	-	-	-	-	-
Follow-up Headway	3.554	3.345	-	-	2.227	-
Pot Capacity-1 Maneuver	91	597	-	-	741	-
Stage 1	404	-	-	-	-	-
Stage 2	394	-	-	-	-	-
Time blocked-Platoon(%)	0	0	-	-	0	-
Mov Capacity-1 Maneuver	72	597	-	-	741	-
Mov Capacity-2 Maneuver	72	-	-	-	-	-
Stage 1	404	-	-	-	-	-
Stage 2	313	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay (s)	75.5	0	1.2
HCM LOS	F	A	A

Lane	NBT	NBR	WBLn1	SBL	SBT
Capacity (vph)			371		
HCM Control Delay (s)	-	-	75.5	10.554	-
HCM Lane VC Ratio	-	-	0.979	0.126	-
HCM Lane LOS	-	-	F	B	-
HCM 95th Percentile Queue (veh)	-	-	11.193	0.428	-

Intersection	
Intersection Delay (sec/veh):	9.4

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Volume (vph)	149	375	413	105	105	109
Conflicting Peds.(#/hr)	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
Right Turn Channelized	None	None	Yield	Yield	Free	Free
Storage Length	0			0	0	0
Median Width		0	0		12	
Grade (%)		0%	0%		0%	
Peak Hour Factor	1.00	0.98	0.97	0.94	0.80	0.74
Heavy Vehicles(%)	3	2	5	4	3	2
Movement Flow Rate	149	383	426	112	131	147
Number of Lanes	0	1	1	0	1	1

Major/Minor	Major 1		Major 2			
Conflicting Flow Rate - All	538	0	0	0	1163	482
Stage 1	-	-	-	-	482	-
Stage 2	-	-	-	-	681	-
Follow-up Headway	2.227	-	-	-	3.527	3.318
Pot Capacity-1 Maneuver	1025	-	-	-	214	584
Stage 1	-	-	-	-	619	-
Stage 2	-	-	-	-	501	-
Time blocked-Platoon(%)	0	-	-	-	0	0
Mov Capacity-1 Maneuver	1025	-	-	-	174	584
Mov Capacity-2 Maneuver	-	-	-	-	174	-
Stage 1	-	-	-	-	619	-
Stage 2	-	-	-	-	408	-

Approach	EB	WB	SB
HCM Control Delay (s)	2.6	0	40.3
HCM LOS	A	A	E

Lane	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (vph)					174	584
HCM Control Delay (s)	9.109	-	-	-	70.8	13.2
HCM Lane VC Ratio	0.145	-	-	-	0.754	0.252
HCM Lane LOS	A	-	-	-	F	B
HCM 95th Percentile Queue (veh)	0.508	-	-	-	4.835	0.994

Intersection	
Intersection Delay (sec/veh):	1.1

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume (vph)	3	460	18	18	496	5	16	0	16	3	0	5
Conflicting Peds.(#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
Right Turn Channelized	None	None	None	None	None	None	None	None	None	None	None	None
Storage Length	0		0	330		0	0		0	0		0
Median Width		12			12			0			0	
Grade (%)		0%			0%			0%			0%	
Peak Hour Factor	0.75	0.95	0.92	0.92	0.98	1.00	0.92	0.92	0.92	0.75	0.92	0.42
Heavy Vehicles(%)	0	2	50	50	4	0	50	5	50	0	5	0
Movement Flow Rate	4	484	20	20	506	5	17	0	17	4	0	12
Number of Lanes	0	1	0	1	1	0	0	1	0	0	1	0

Major/Minor	Major 1			Major 2			Minor 1			Minor 2		
Conflicting Flow Rate - All	511	0	0	504	0	0	1057	1053	494	1060	1061	256
Stage 1	-	-	-	-	-	-	502	502	-	549	549	-
Stage 2	-	-	-	-	-	-	555	551	-	511	512	-
Follow-up Headway	2.2	-	-	2.65	-	-	3.95	4.045	3.75	3.5	4.045	3.3
Pot Capacity-1 Maneuver	1065	-	-	854	-	-	165	223	490	204	221	788
Stage 1	-	-	-	-	-	-	472	537	-	524	512	-
Stage 2	-	-	-	-	-	-	440	510	-	549	532	-
Time blocked-Platoon(%)	0	-	-	0	-	-	0	0	0	0	0	0
Mov Capacity-1 Maneuver	1065	-	-	854	-	-	159	217	490	193	215	788
Mov Capacity-2 Maneuver	-	-	-	-	-	-	159	217	-	193	215	-
Stage 1	-	-	-	-	-	-	470	534	-	521	500	-
Stage 2	-	-	-	-	-	-	423	498	-	527	529	-

Approach	EB	WB	NB	SB
HCM Control Delay (s)	0.1	0.3	22.5	13.4
HCM LOS	A	A	C	B

Lane	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (vph)	240							444
HCM Control Delay (s)	22.5	8.393	0	-	9.314	0	-	13.4
HCM Lane VC Ratio	0.145	0.004	-	-	0.023	-	-	0.036
HCM Lane LOS	C	A	A	-	A	A	-	B
HCM 95th Percentile Queue (veh)	0.499	0.011	-	-	0.07	-	-	0.111

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	371	41	76	477	382	436
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0	0	0			450
Storage Lanes	1	1	1			1
Taper Length (ft)	100		100			
Satd. Flow (prot)	1787	1615	1805	1845	1881	1583
Flt Permitted	0.950		0.950			
Satd. Flow (perm)	1787	1615	1805	1845	1881	1583
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)		127				501
Link Speed (mph)	30			30	30	
Link Distance (ft)	220			382	754	
Travel Time (s)	5.0			8.7	17.1	
Peak Hour Factor	0.83	0.68	1.00	1.00	0.95	0.87
Heavy Vehicles (%)	1%	0%	0%	3%	1%	2%
Shared Lane Traffic (%)						
Lane Group Flow (vph)	447	60	76	477	402	501
Turn Type	NA	Perm	Prot	NA	NA	Perm
Protected Phases	3		1	6	2	
Permitted Phases		3				2
Detector Phase	3	3	1	6	2	2
Switch Phase						
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	21.0	21.0	9.0	9.0	21.0	21.0
Total Split (s)	26.0	26.0	9.0	34.0	25.0	25.0
Total Split (%)	43.3%	43.3%	15.0%	56.7%	41.7%	41.7%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag			Lead		Lag	Lag
Lead-Lag Optimize?						
Recall Mode	None	None	None	None	Max	Max
Act Effct Green (s)	17.5	17.5	4.1	27.2	20.4	20.4
Actuated g/C Ratio	0.32	0.32	0.07	0.50	0.37	0.37
v/c Ratio	0.79	0.10	0.57	0.52	0.57	0.55
Control Delay	28.7	0.7	47.1	12.7	19.8	4.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	28.7	0.7	47.1	12.7	19.8	4.5
LOS	C	A	D	B	B	A
Approach Delay	25.4			17.4	11.3	
Approach LOS	C			B	B	
Queue Length 50th (ft)	137	0	27	106	116	0
Queue Length 95th (ft)	204	0	#84	187	204	49
Internal Link Dist (ft)	140			302	674	
Turn Bay Length (ft)						450
Base Capacity (vph)	698	708	134	995	700	903
Starvation Cap Reductn	0	0	0	0	0	0

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.64	0.08	0.57	0.48	0.57	0.55

Intersection Summary	
Area Type: Other	
Cycle Length: 60	
Actuated Cycle Length: 54.9	
Natural Cycle: 55	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 0.79	
Intersection Signal Delay: 16.7	Intersection LOS: B
Intersection Capacity Utilization 57.4%	ICU Level of Service B
Analysis Period (min) 15	

\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 3: J. P. Leong Hwy/Kamehameha Hwy

Intersection	
Intersection Delay (sec/veh):	22.2

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Volume (vph)	56	255	729	92	83	759
Conflicting Peds.(#/hr)	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
Right Turn Channelized	Yield	Yield	Yield	Yield	None	None
Storage Length	0	0		200	0	
Median Width	12		0			0
Grade (%)	0%		0%			0%
Peak Hour Factor	1.00	1.00	0.91	0.79	0.78	0.92
Heavy Vehicles(%)	7	2	2	6	4	3
Movement Flow Rate	56	255	801	116	106	825
Number of Lanes	1	0	1	1	0	1

Major/Minor			Major 1			Major 2
Conflicting Flow Rate - All	1896	459	0	0	917	0
Stage 1	859	-	-	-	-	-
Stage 2	1037	-	-	-	-	-
Follow-up Headway	3.563	3.318	-	-	2.236	-
Pot Capacity-1 Maneuver	74	602	-	-	736	-
Stage 1	407	-	-	-	-	-
Stage 2	334	-	-	-	-	-
Time blocked-Platoon(%)	0	0	-	-	0	-
Mov Capacity-1 Maneuver	# 54	602	-	-	736	-
Mov Capacity-2 Maneuver	# 54	-	-	-	-	-
Stage 1	407	-	-	-	-	-
Stage 2	245	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay (s)	150.9	0	1.2
HCM LOS	F	A	A

Lane	NBT	NBR	WBLn1	SBL	SBT
Capacity (vph)			265		
HCM Control Delay (s)	-	-	150.9	10.716	-
HCM Lane VC Ratio	-	-	1.174	0.145	-
HCM Lane LOS	-	-	F	B	-
HCM 95th Percentile Queue (veh)	-	-	14.05	0.504	-

HCS+: Two-Lane Highways Release 5.4

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Two-Way Two-Lane Highway Segment Analysis

Analyst	RSO
Agency/Co.	Traffic Management Consultant
Date Performed	11/3/11
Analysis Time Period	AM Peak Hour W/O Project
Highway	Kamehameha Highway
From/To	West of Kuilima Drive
Jurisdiction	
Analysis Year	2025
Description	Turtle Bay Resort Master Plan

Input Data

Highway class	Class 1				
Shoulder width	6.0	ft	Peak-hour factor, PHF	0.93	
Lane width	12.0	ft	% Trucks and buses	8	%
Segment length	0.0	mi	% Recreational vehicles	0	%
Terrain type	Level		% No-passing zones	50	%
Grade: Length		mi	Access points/mi	2	/mi
Up/down		%			

Two-way hourly volume, V	640	veh/h		
Directional split	51 / 49	%		

Average Travel Speed

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.2	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor,	0.984	
Two-way flow rate,(note-1) vp	699	pc/h
Highest directional split proportion (note-2)	356	pc/h

Free-Flow Speed from Field Measurement:		
Field measured speed, SFM	-	mi/h
Observed volume, Vf	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed, BFFS	45.0	mi/h
Adj. for lane and shoulder width, fLS	0.0	mi/h
Adj. for access points, fA	0.5	mi/h
Free-flow speed, FFS	44.5	mi/h

Adjustment for no-passing zones, fnp	2.4	mi/h
Average travel speed, ATS	36.6	mi/h

Percent Time-Spent-Following

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.1	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor, fHV	0.992	
Two-way flow rate,(note-1) vp	694	pc/h
Highest directional split proportion (note-2)	354	
Base percent time-spent-following, BPTSF	45.7	%
Adj.for directional distribution and no-passing zones, fd/np	15.3	
Percent time-spent-following, PTSF	61.0	%

Level of Service and Other Performance Measures

Level of service, LOS	E	
Volume to capacity ratio, v/c	0.22	
Peak 15-min vehicle-miles of travel, VMT15	0	veh-mi
Peak-hour vehicle-miles of travel, VMT60	0	veh-mi
Peak 15-min total travel time, TT15	0.0	veh-h

Notes:
1. If vp >= 3200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split vp >= 1700 pc/h, terminate analysis-the LOS is F.

HCS+: Two-Lane Highways Release 5.4

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Two-Way Two-Lane Highway Segment Analysis

Analyst	RSO
Agency/Co.	Traffic Management Consultant
Date Performed	11/1/2011
Analysis Time Period	AM Peak Hour W/O Project
Highway	Kamehameha Highway
From/To	Haleiwa to Kawailoa
Jurisdiction	
Analysis Year	2025
Description	Turtle Bay Resort Master Plan

Input Data

Highway class	Class 1				
Shoulder width	6.0	ft	Peak-hour factor, PHF	0.94	
Lane width	12.0	ft	% Trucks and buses	5	%
Segment length	0.0	mi	% Recreational vehicles	0	%
Terrain type	Level		% No-passing zones	80	%
Grade: Length		mi	Access points/mi	2	/mi
Up/down		%			

Two-way hourly volume, V	1142	veh/h	
Directional split	51 / 49	%	

Average Travel Speed

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.1	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor,	0.995	
Two-way flow rate,(note-1) vp	1221	pc/h
Highest directional split proportion (note-2)	623	pc/h
Free-Flow Speed from Field Measurement:		
Field measured speed, SFM	-	mi/h
Observed volume, Vf	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed, BFFS	45.0	mi/h
Adj. for lane and shoulder width, fLS	0.0	mi/h
Adj. for access points, fA	0.5	mi/h
Free-flow speed, FFS	44.5	mi/h
Adjustment for no-passing zones, fnp	1.8	mi/h

Average travel speed, ATS 33.2 mi/h

Percent Time-Spent-Following

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.0	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor, fHV	1.000	
Two-way flow rate,(note-1) vp	1215	pc/h
Highest directional split proportion (note-2)	620	
Base percent time-spent-following, BPTSF	65.6	%
Adj.for directional distribution and no-passing zones, fd/np	9.5	
Percent time-spent-following, PTSF	75.1	%

Level of Service and Other Performance Measures

Level of service, LOS	E	
Volume to capacity ratio, v/c	0.38	
Peak 15-min vehicle-miles of travel, VMT15	0	veh-mi
Peak-hour vehicle-miles of travel, VMT60	0	veh-mi
Peak 15-min total travel time, TT15	0.0	veh-h

Notes:
1. If vp >= 3200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split vp >= 1700 pc/h, terminate analysis-the LOS is F.

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Two-Way Two-Lane Highway Segment Analysis

Analyst	RSO
Agency/Co.	Traffic Management Consultant
Date Performed	11/1/2011
Analysis Time Period	AM Peak Hour W/O Project
Highway	Kamehameha Highway
From/To	Hygienic Store
Jurisdiction	
Analysis Year	2025
Description	Turtle Bay Resort Master Plan

Input Data

Highway class	Class 1				
Shoulder width	6.0	ft	Peak-hour factor, PHF	0.89	
Lane width	12.0	ft	% Trucks and buses	3	%
Segment length	0.0	mi	% Recreational vehicles	0	%
Terrain type	Level		% No-passing zones	80	%
Grade: Length		mi	Access points/mi	10	/mi
Up/down		%			

Two-way hourly volume, V	1455	veh/h	
Directional split	67 / 33	%	

Average Travel Speed

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.1	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor,	0.997	
Two-way flow rate,(note-1) vp	1640	pc/h
Highest directional split proportion (note-2)	1099	pc/h
Free-Flow Speed from Field Measurement:		
Field measured speed, SFM	-	mi/h
Observed volume, Vf	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed, BFFS	45.0	mi/h
Adj. for lane and shoulder width, fLS	0.0	mi/h
Adj. for access points, fA	2.5	mi/h
Free-flow speed, FFS	42.5	mi/h
Adjustment for no-passing zones, fnp	1.3	mi/h

Average travel speed, ATS 28.5 mi/h

Percent Time-Spent-Following

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.0	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor, fHV	1.000	
Two-way flow rate,(note-1) vp	1635	pc/h
Highest directional split proportion (note-2)	1095	
Base percent time-spent-following, BPTSF	76.2	%
Adj.for directional distribution and no-passing zones, fd/np	6.3	
Percent time-spent-following, PTSF	82.5	%

Level of Service and Other Performance Measures

Level of service, LOS	E	
Volume to capacity ratio, v/c	0.51	
Peak 15-min vehicle-miles of travel, VMT15	0	veh-mi
Peak-hour vehicle-miles of travel, VMT60	0	veh-mi
Peak 15-min total travel time, TT15	0.0	veh-h

Notes:
1. If vp >= 3200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split vp >= 1700 pc/h, terminate analysis-the LOS is F.

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Two-Way Two-Lane Highway Segment Analysis

Analyst	RSO
Agency/Co.	Traffic Management Consultant
Date Performed	11/3/11
Analysis Time Period	PM Peak Hour W/O Project
Highway	Kamehameha Highway
From/To	West of Kuilima Drive
Jurisdiction	
Analysis Year	2025
Description	Turtle Bay Resort Master Plan

Input Data

Highway class	Class 1				
Shoulder width	6.0	ft	Peak-hour factor, PHF	0.85	
Lane width	12.0	ft	% Trucks and buses	4	%
Segment length	0.0	mi	% Recreational vehicles	0	%
Terrain type	Level		% No-passing zones	50	%
Grade: Length		mi	Access points/mi	2	/mi
Up/down		%			

Two-way hourly volume, V	896	veh/h		
Directional split	51 / 49	%		

Average Travel Speed

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.2	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor,	0.992	
Two-way flow rate,(note-1) vp	1063	pc/h
Highest directional split proportion (note-2)	542	pc/h
Free-Flow Speed from Field Measurement:		
Field measured speed, SFM	-	mi/h
Observed volume, Vf	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed, BFFS	45.0	mi/h
Adj. for lane and shoulder width, fLS	0.0	mi/h
Adj. for access points, fA	0.5	mi/h
Free-flow speed, FFS	44.5	mi/h
Adjustment for no-passing zones, fnp	1.7	mi/h

Average travel speed, ATS 34.6 mi/h

Percent Time-Spent-Following

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.1	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor, fHV	0.996	
Two-way flow rate,(note-1) vp	1058	pc/h
Highest directional split proportion (note-2)	540	
Base percent time-spent-following, BPTSF	60.5	%
Adj.for directional distribution and no-passing zones, fd/np	10.1	
Percent time-spent-following, PTSF	70.6	%

Level of Service and Other Performance Measures

Level of service, LOS	E	
Volume to capacity ratio, v/c	0.33	
Peak 15-min vehicle-miles of travel, VMT15	0	veh-mi
Peak-hour vehicle-miles of travel, VMT60	0	veh-mi
Peak 15-min total travel time, TT15	0.0	veh-h

Notes:
1. If vp >= 3200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split vp >= 1700 pc/h, terminate analysis-the LOS is F.

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Two-Way Two-Lane Highway Segment Analysis

Analyst	RSO
Agency/Co.	Traffic Management Consultant
Date Performed	11/1/2011
Analysis Time Period	PM Peak Hour W/O Project
Highway	Kamehameha Highway
From/To	Haleiwa to Kawailoa
Jurisdiction	
Analysis Year	2025
Description	Turtle Bay Resort Master Plan

Input Data

Highway class	Class 1				
Shoulder width	6.0	ft	Peak-hour factor, PHF	0.94	
Lane width	12.0	ft	% Trucks and buses	2	%
Segment length	0.0	mi	% Recreational vehicles	0	%
Terrain type	Level		% No-passing zones	80	%
Grade: Length		mi	Access points/mi	2	/mi
Up/down		%			

Two-way hourly volume, V	1548	veh/h	
Directional split	51 / 49	%	

Average Travel Speed

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.1	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor,	0.998	
Two-way flow rate,(note-1) vp	1650	pc/h
Highest directional split proportion (note-2)	842	pc/h
Free-Flow Speed from Field Measurement:		
Field measured speed, SFM	-	mi/h
Observed volume, Vf	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed, BFFS	45.0	mi/h
Adj. for lane and shoulder width, fLS	0.0	mi/h
Adj. for access points, fA	0.5	mi/h
Free-flow speed, FFS	44.5	mi/h
Adjustment for no-passing zones, fnp	1.3	mi/h

Average travel speed, ATS 30.4 mi/h

Percent Time-Spent-Following

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.0	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor, fHV	1.000	
Two-way flow rate,(note-1) vp	1647	pc/h
Highest directional split proportion (note-2)	840	
Base percent time-spent-following, BPTSF	76.5	%
Adj.for directional distribution and no-passing zones, fd/np	6.0	
Percent time-spent-following, PTSF	82.5	%

Level of Service and Other Performance Measures

Level of service, LOS	E	
Volume to capacity ratio, v/c	0.52	
Peak 15-min vehicle-miles of travel, VMT15	0	veh-mi
Peak-hour vehicle-miles of travel, VMT60	0	veh-mi
Peak 15-min total travel time, TT15	0.0	veh-h

Notes:
1. If vp >= 3200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split vp >= 1700 pc/h, terminate analysis-the LOS is F.

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Two-Way Two-Lane Highway Segment Analysis

Analyst	RSO
Agency/Co.	Traffic Management Consultant
Date Performed	11/1/2011
Analysis Time Period	PM Peak Hour W/O Project
Highway	Kamehameha Highway
From/To	Hygienic Store
Jurisdiction	
Analysis Year	2025
Description	Turtle Bay Resort Master Plan

Input Data

Highway class	Class 1				
Shoulder width	6.0	ft	Peak-hour factor, PHF	0.99	
Lane width	12.0	ft	% Trucks and buses	5	%
Segment length	0.0	mi	% Recreational vehicles	0	%
Terrain type	Level		% No-passing zones	80	%
Grade: Length		mi	Access points/mi	10	/mi
Up/down		%			

Two-way hourly volume, V	1877	veh/h	
Directional split	57 / 43	%	

Average Travel Speed

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.1	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor,	0.995	
Two-way flow rate,(note-1) vp	1905	pc/h
Highest directional split proportion (note-2)	1086	pc/h
Free-Flow Speed from Field Measurement:		
Field measured speed, SFM	-	mi/h
Observed volume, Vf	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed, BFFS	45.0	mi/h
Adj. for lane and shoulder width, fLS	0.0	mi/h
Adj. for access points, fA	2.5	mi/h
Free-flow speed, FFS	42.5	mi/h
Adjustment for no-passing zones, fnp	1.0	mi/h

Average travel speed, ATS 26.7 mi/h

Percent Time-Spent-Following

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.0	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor, fHV	1.000	
Two-way flow rate,(note-1) vp	1896	pc/h
Highest directional split proportion (note-2)	1081	
Base percent time-spent-following, BPTSF	81.1	%
Adj.for directional distribution and no-passing zones, fd/np	4.6	
Percent time-spent-following, PTSF	85.7	%

Level of Service and Other Performance Measures

Level of service, LOS	E	
Volume to capacity ratio, v/c	0.60	
Peak 15-min vehicle-miles of travel, VMT15	0	veh-mi
Peak-hour vehicle-miles of travel, VMT60	0	veh-mi
Peak 15-min total travel time, TT15	0.0	veh-h

Notes:
1. If vp >= 3200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split vp >= 1700 pc/h, terminate analysis-the LOS is F.

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Two-Way Two-Lane Highway Segment Analysis

Analyst	RSO
Agency/Co.	Traffic Management Consultant
Date Performed	11/5/11
Analysis Time Period	Saturday Peak Hour W/O Project
Highway	Kamehameha Highway
From/To	West of Kuilima Drive
Jurisdiction	
Analysis Year	2025
Description	Turtle Bay Resort Master Plan

Input Data

Highway class	Class 1				
Shoulder width	6.0	ft	Peak-hour factor, PHF	0.94	
Lane width	12.0	ft	% Trucks and buses	3	%
Segment length	0.0	mi	% Recreational vehicles	0	%
Terrain type	Level		% No-passing zones	50	%
Grade: Length		mi	Access points/mi	2	/mi
Up/down		%			

Two-way hourly volume, V	1046	veh/h	
Directional split	50 / 50	%	

Average Travel Speed

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.2	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor,	0.994	
Two-way flow rate,(note-1) vp	1119	pc/h
Highest directional split proportion (note-2)	560	pc/h
Free-Flow Speed from Field Measurement:		
Field measured speed, SFM	-	mi/h
Observed volume, Vf	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed, BFFS	45.0	mi/h
Adj. for lane and shoulder width, fLS	0.0	mi/h
Adj. for access points, fA	0.5	mi/h
Free-flow speed, FFS	44.5	mi/h
Adjustment for no-passing zones, fnp	1.6	mi/h

Average travel speed, ATS 34.3 mi/h

Percent Time-Spent-Following

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.1	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor, fHV	0.997	
Two-way flow rate,(note-1) vp	1116	pc/h
Highest directional split proportion (note-2)	558	
Base percent time-spent-following, BPTSF	62.5	%
Adj.for directional distribution and no-passing zones, fd/np	9.5	
Percent time-spent-following, PTSF	72.0	%

Level of Service and Other Performance Measures

Level of service, LOS	E	
Volume to capacity ratio, v/c	0.35	
Peak 15-min vehicle-miles of travel, VMT15	0	veh-mi
Peak-hour vehicle-miles of travel, VMT60	0	veh-mi
Peak 15-min total travel time, TT15	0.0	veh-h

Notes:
1. If vp >= 3200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split vp >= 1700 pc/h, terminate analysis-the LOS is F.

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Two-Way Two-Lane Highway Segment Analysis

Analyst	RSO
Agency/Co.	Traffic Management Consultant
Date Performed	10/29/2011
Analysis Time Period	Saturday Peak Hour W/O Project
Highway	Kamehameha Highway
From/To	Haleiwa to Kawailoa
Jurisdiction	
Analysis Year	2025
Description	Turtle Bay Resort Master Plan

Input Data

Highway class	Class 1				
Shoulder width	6.0	ft	Peak-hour factor, PHF	0.92	
Lane width	12.0	ft	% Trucks and buses	2	%
Segment length	0.0	mi	% Recreational vehicles	0	%
Terrain type	Level		% No-passing zones	80	%
Grade: Length		mi	Access points/mi	2	/mi
Up/down		%			

Two-way hourly volume, V	1667	veh/h	
Directional split	51 / 49	%	

Average Travel Speed

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.1	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor,	0.998	
Two-way flow rate,(note-1) vp	1816	pc/h
Highest directional split proportion (note-2)	926	pc/h
Free-Flow Speed from Field Measurement:		
Field measured speed, SFM	-	mi/h
Observed volume, Vf	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed, BFFS	45.0	mi/h
Adj. for lane and shoulder width, fLS	0.0	mi/h
Adj. for access points, fA	0.5	mi/h
Free-flow speed, FFS	44.5	mi/h
Adjustment for no-passing zones, fnp	1.1	mi/h

Average travel speed, ATS 29.3 mi/h

Percent Time-Spent-Following

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.0	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor, fHV	1.000	
Two-way flow rate,(note-1) vp	1812	pc/h
Highest directional split proportion (note-2)	924	
Base percent time-spent-following, BPTSF	79.7	%
Adj.for directional distribution and no-passing zones, fd/np	5.1	
Percent time-spent-following, PTSF	84.8	%

Level of Service and Other Performance Measures

Level of service, LOS	E	
Volume to capacity ratio, v/c	0.57	
Peak 15-min vehicle-miles of travel, VMT15	0	veh-mi
Peak-hour vehicle-miles of travel, VMT60	0	veh-mi
Peak 15-min total travel time, TT15	0.0	veh-h

Notes:
1. If vp >= 3200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split vp >= 1700 pc/h, terminate analysis-the LOS is F.

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Two-Way Two-Lane Highway Segment Analysis

Analyst	RSO
Agency/Co.	Traffic Management Consultant
Date Performed	10/29/2011
Analysis Time Period	Sat Peak Hr W/O Project
Highway	Kamehameha Highway
From/To	Hygienic Store
Jurisdiction	
Analysis Year	2025
Description	Turtle Bay Resort Master Plan

Input Data

Highway class	Class 1				
Shoulder width	6.0	ft	Peak-hour factor, PHF	0.94	
Lane width	12.0	ft	% Trucks and buses	3	%
Segment length	0.0	mi	% Recreational vehicles	0	%
Terrain type	Level		% No-passing zones	80	%
Grade: Length		mi	Access points/mi	10	/mi
Up/down		%			

Two-way hourly volume, V	1826	veh/h	
Directional split	54 / 46	%	

Average Travel Speed

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.1	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor,	0.997	
Two-way flow rate,(note-1) vp	1948	pc/h
Highest directional split proportion (note-2)	1052	pc/h
Free-Flow Speed from Field Measurement:		
Field measured speed, SFM	-	mi/h
Observed volume, Vf	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed, BFFS	45.0	mi/h
Adj. for lane and shoulder width, fLS	0.0	mi/h
Adj. for access points, fA	2.5	mi/h
Free-flow speed, FFS	42.5	mi/h
Adjustment for no-passing zones, fnp	1.0	mi/h

Average travel speed, ATS 26.4 mi/h

Percent Time-Spent-Following

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.0	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor, fHV	1.000	
Two-way flow rate,(note-1) vp	1943	pc/h
Highest directional split proportion (note-2)	1049	
Base percent time-spent-following, BPTSF	81.9	%
Adj.for directional distribution and no-passing zones, fd/np	4.4	
Percent time-spent-following, PTSF	86.3	%

Level of Service and Other Performance Measures

Level of service, LOS	E	
Volume to capacity ratio, v/c	0.61	
Peak 15-min vehicle-miles of travel, VMT15	0	veh-mi
Peak-hour vehicle-miles of travel, VMT60	0	veh-mi
Peak 15-min total travel time, TT15	0.0	veh-h

Notes:
1. If vp >= 3200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split vp >= 1700 pc/h, terminate analysis-the LOS is F.

TRAFFIC IMPACT ANALYSIS REPORT

FOR THE PROPOSED

TURTLE BAY RESORT MASTER PLAN

KAHUKU, OAHU, HAWAII

APPENDIX D

CAPACITY ANALYSIS WORKSHEETS

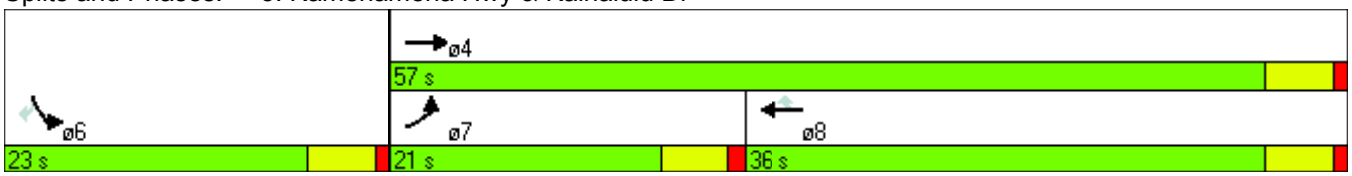
2025 TRAFFIC CONDITIONS WITH FULL BUILD OUT ALTERNATIVE

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	405	445	465	157	206	402
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)	300			400	0	0
Storage Lanes	2			1	1	1
Taper Length (ft)	100				100	
Satd. Flow (prot)	3367	1681	1792	1509	1703	1509
Flt Permitted	0.950				0.950	
Satd. Flow (perm)	3367	1681	1792	1509	1703	1509
Right Turn on Red				Yes		Yes
Satd. Flow (RTOR)				171		437
Link Speed (mph)		45	45		30	
Link Distance (ft)		500	3000		500	
Travel Time (s)		7.6	45.5		11.4	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	4%	13%	6%	7%	6%	7%
Shared Lane Traffic (%)						
Lane Group Flow (vph)	440	484	505	171	224	437
Turn Type	Prot	NA	NA	Perm	NA	Perm
Protected Phases	7	4	8		6	
Permitted Phases				8		6
Detector Phase	7	4	8	8	6	6
Switch Phase						
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	10.0	22.0	22.0	22.0	22.0	22.0
Total Split (s)	21.0	57.0	36.0	36.0	23.0	23.0
Total Split (%)	26.3%	71.3%	45.0%	45.0%	28.8%	28.8%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead		Lag	Lag		
Lead-Lag Optimize?						
Recall Mode	None	None	None	None	Max	Max
Act Effct Green (s)	13.7	43.3	24.5	24.5	18.3	18.3
Actuated g/C Ratio	0.19	0.60	0.34	0.34	0.26	0.26
v/c Ratio	0.68	0.48	0.83	0.27	0.52	0.62
Control Delay	33.9	9.3	34.0	4.1	30.3	7.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	33.9	9.3	34.0	4.1	30.3	7.3
LOS	C	A	C	A	C	A
Approach Delay		21.0	26.5		15.1	
Approach LOS		C	C		B	
Queue Length 50th (ft)	96	104	204	0	90	0
Queue Length 95th (ft)	152	164	326	37	172	76
Internal Link Dist (ft)		420	2920		420	
Turn Bay Length (ft)	300			400		
Base Capacity (vph)	762	1237	786	758	434	710
Starvation Cap Reductn	0	0	0	0	0	0

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.58	0.39	0.64	0.23	0.52	0.62

Intersection Summary	
Area Type: Other	
Cycle Length: 80	
Actuated Cycle Length: 71.7	
Natural Cycle: 60	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 0.83	
Intersection Signal Delay: 20.9	Intersection LOS: C
Intersection Capacity Utilization 59.9%	ICU Level of Service B
Analysis Period (min) 15	

Splits and Phases: 3: Kamehameha Hwy & Kaihalulu Dr

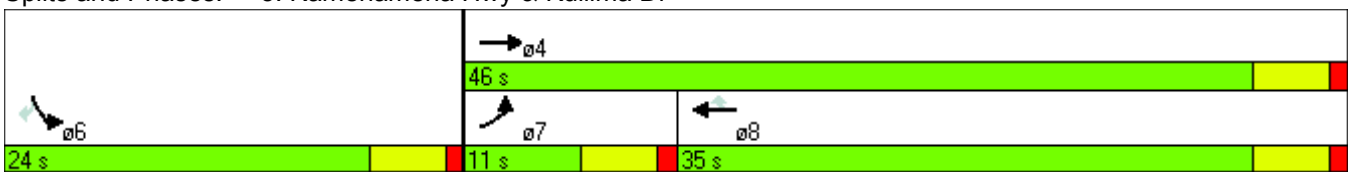


Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	149	502	471	180	238	151
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)	200			400	0	0
Storage Lanes	2			1	1	1
Taper Length (ft)	100				100	
Satd. Flow (prot)	3367	1681	1792	1509	1703	1509
Flt Permitted	0.950				0.950	
Satd. Flow (perm)	3363	1681	1792	1480	1677	1490
Right Turn on Red				Yes		Yes
Satd. Flow (RTOR)				196		164
Link Speed (mph)		45	45		25	
Link Distance (ft)		500	5500		500	
Travel Time (s)		7.6	83.3		13.6	
Confl. Peds. (#/hr)	1			1	7	
Confl. Bikes (#/hr)				12		1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	4%	13%	6%	7%	6%	7%
Shared Lane Traffic (%)						
Lane Group Flow (vph)	162	546	512	196	259	164
Turn Type	Prot	NA	NA	Perm	NA	Perm
Protected Phases	7	4	8		6	
Permitted Phases				8		6
Detector Phase	7	4	8	8	6	6
Switch Phase						
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	9.0	21.0	21.0	21.0	21.0	21.0
Total Split (s)	11.0	46.0	35.0	35.0	24.0	24.0
Total Split (%)	15.7%	65.7%	50.0%	50.0%	34.3%	34.3%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead		Lag	Lag		
Lead-Lag Optimize?						
Recall Mode	None	None	None	None	Min	Min
Act Effct Green (s)	6.6	29.5	21.4	21.4	13.8	13.8
Actuated g/C Ratio	0.12	0.54	0.39	0.39	0.25	0.25
v/c Ratio	0.40	0.60	0.73	0.28	0.60	0.33
Control Delay	30.3	11.4	22.0	3.4	26.6	6.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	30.3	11.4	22.0	3.4	26.6	6.0
LOS	C	B	C	A	C	A
Approach Delay		15.7	16.8		18.6	
Approach LOS		B	B		B	
Queue Length 50th (ft)	27	101	144	0	78	0
Queue Length 95th (ft)	63	211	272	33	166	41
Internal Link Dist (ft)		420	5420		420	
Turn Bay Length (ft)	200			400		

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Base Capacity (vph)	407	1269	1084	972	652	672
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.40	0.43	0.47	0.20	0.40	0.24

Intersection Summary	
Area Type: Other	
Cycle Length: 70	
Actuated Cycle Length: 54.2	
Natural Cycle: 60	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 0.73	
Intersection Signal Delay: 16.8	Intersection LOS: B
Intersection Capacity Utilization 54.7%	ICU Level of Service A
Analysis Period (min) 15	

Splits and Phases: 5: Kamehameha Hwy & Kuilima Dr



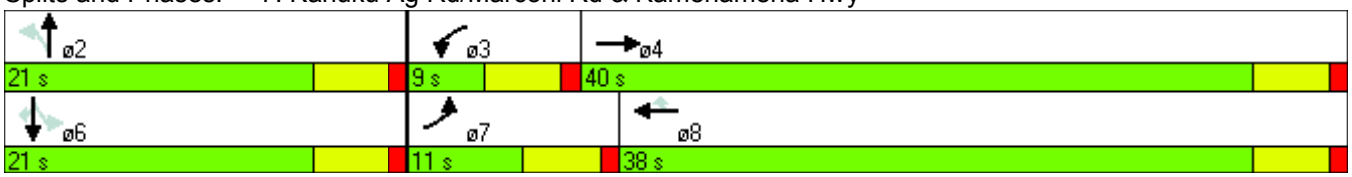
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	82	641	17	19	548	73	24	0	18	73	0	79
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	200		0	330		400	0		0	0		200
Storage Lanes	1		0	1		1	0		0	0		1
Taper Length (ft)	100			100			100			100		
Satd. Flow (prot)	1805	1661	0	1203	1792	1615	0	1160	0	0	1805	1615
Flt Permitted	0.950			0.950				0.792			0.727	
Satd. Flow (perm)	1805	1661	0	1203	1792	1570	0	944	0	0	1381	1615
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		3				109		109				109
Link Speed (mph)		45			45			30			25	
Link Distance (ft)		500			1200			500			500	
Travel Time (s)		7.6			18.2			11.4			13.6	
Confl. Bikes (#/hr)						10						
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	0%	13%	50%	50%	6%	0%	50%	2%	50%	0%	2%	0%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	89	715	0	21	596	79	0	46	0	0	79	86
Turn Type	Prot	NA		Prot	NA	Perm	Perm	NA		Perm	NA	Perm
Protected Phases	7	4		3	8			2			6	
Permitted Phases						8	2			6		6
Detector Phase	7	4		3	8	8	2	2		6	6	6
Switch Phase												
Minimum Initial (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Minimum Split (s)	9.0	21.0		9.0	21.0	21.0	21.0	21.0		21.0	21.0	21.0
Total Split (s)	11.0	40.0		9.0	38.0	38.0	21.0	21.0		21.0	21.0	21.0
Total Split (%)	15.7%	57.1%		12.9%	54.3%	54.3%	30.0%	30.0%		30.0%	30.0%	30.0%
Yellow Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
All-Red Time (s)	1.0	1.0		1.0	1.0	1.0	1.0	1.0		1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0		0.0	0.0	0.0		0.0			0.0	0.0
Total Lost Time (s)	5.0	5.0		5.0	5.0	5.0		5.0			5.0	5.0
Lead/Lag	Lead	Lag		Lead	Lag	Lag						
Lead-Lag Optimize?												
Recall Mode	None	None		None	None	None	Min	Min		Min	Min	Min
Act Effct Green (s)	6.4	29.8		4.3	23.0	23.0		8.8			8.8	8.8
Actuated g/C Ratio	0.13	0.59		0.08	0.45	0.45		0.17			0.17	0.17
v/c Ratio	0.39	0.73		0.21	0.73	0.10		0.18			0.33	0.23
Control Delay	32.1	14.7		32.8	18.7	1.6		1.6			25.7	5.6
Queue Delay	0.0	0.0		0.0	0.0	0.0		0.0			0.0	0.0
Total Delay	32.1	14.7		32.8	18.7	1.6		1.6			25.7	5.6
LOS	C	B		C	B	A		A			C	A
Approach Delay		16.6			17.2			1.6			15.2	
Approach LOS		B			B			A			B	
Queue Length 50th (ft)	26	109		6	146	0		0			22	0
Queue Length 95th (ft)	#89	#437		28	282	12		2			63	24
Internal Link Dist (ft)		420			1120			420			420	
Turn Bay Length (ft)	200			330		400						200
Base Capacity (vph)	229	1202		102	1222	1105		392			469	620

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Starvation Cap Reductn	0	0		0	0	0		0			0	0
Spillback Cap Reductn	0	0		0	0	0		0			0	0
Storage Cap Reductn	0	0		0	0	0		0			0	0
Reduced v/c Ratio	0.39	0.59		0.21	0.49	0.07		0.12			0.17	0.14

Intersection Summary

Area Type: Other
Cycle Length: 70
Actuated Cycle Length: 50.7
Natural Cycle: 65
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.73
Intersection Signal Delay: 16.3 Intersection LOS: B
Intersection Capacity Utilization 59.7% ICU Level of Service B
Analysis Period (min) 15
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 7: Kahuku Ag Rd/Marconi Rd & Kamehameha Hwy



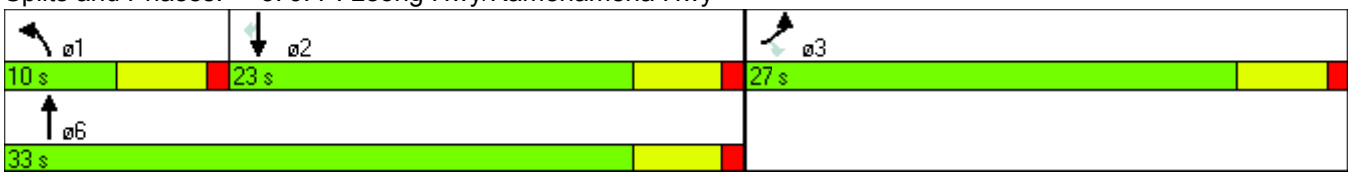
Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	447	27	44	469	406	543
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0	0	0			450
Storage Lanes	1	1	1			1
Taper Length (ft)	100		100			
Satd. Flow (prot)	1719	1615	1805	1792	1845	1568
Flt Permitted	0.950		0.950			
Satd. Flow (perm)	1719	1615	1805	1792	1845	1568
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)		127				578
Link Speed (mph)	30			30	30	
Link Distance (ft)	220			382	754	
Travel Time (s)	5.0			8.7	17.1	
Peak Hour Factor	0.88	1.00	0.61	0.97	1.00	0.94
Heavy Vehicles (%)	5%	0%	0%	6%	3%	3%
Shared Lane Traffic (%)						
Lane Group Flow (vph)	508	27	72	484	406	578
Turn Type	NA	Perm	Prot	NA	NA	Perm
Protected Phases	3		1	6	2	
Permitted Phases		3				2
Detector Phase	3	3	1	6	2	2
Switch Phase						
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	21.0	21.0	9.0	9.0	21.0	21.0
Total Split (s)	27.0	27.0	10.0	33.0	23.0	23.0
Total Split (%)	45.0%	45.0%	16.7%	55.0%	38.3%	38.3%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag			Lead		Lag	Lag
Lead-Lag Optimize?						
Recall Mode	None	None	None	None	Max	Max
Act Effct Green (s)	18.9	18.9	5.1	23.8	18.5	18.5
Actuated g/C Ratio	0.36	0.36	0.10	0.45	0.35	0.35
v/c Ratio	0.83	0.04	0.41	0.60	0.63	0.63
Control Delay	30.6	0.1	33.7	15.2	23.0	5.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	30.6	0.1	33.7	15.2	23.0	5.4
LOS	C	A	C	B	C	A
Approach Delay	29.1			17.6	12.6	
Approach LOS	C			B	B	
Queue Length 50th (ft)	160	0	26	120	130	0
Queue Length 95th (ft)	#300	0	40	202	#249	63
Internal Link Dist (ft)	140			302	674	
Turn Bay Length (ft)						450
Base Capacity (vph)	734	763	175	975	645	924
Starvation Cap Reductn	0	0	0	0	0	0

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.69	0.04	0.41	0.50	0.63	0.63

Intersection Summary

Area Type: Other
Cycle Length: 60
Actuated Cycle Length: 53
Natural Cycle: 60
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.83
Intersection Signal Delay: 18.2 Intersection LOS: B
Intersection Capacity Utilization 62.0% ICU Level of Service B
Analysis Period (min) 15
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 3: J. P. Leong Hwy/Kamehameha Hwy



Intersection	
Intersection Delay (sec/veh):	82.8

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Volume (vph)	42	134	509	152	577	515
Conflicting Peds.(#/hr)	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
Right Turn Channelized	Yield	Yield	Yield	Yield	None	None
Storage Length	0	0		200	0	
Median Width	12		0			0
Grade (%)	0%		0%			0%
Peak Hour Factor	0.75	0.83	0.96	0.83	0.77	1.00
Heavy Vehicles(%)	6	7	5	4	2	3
Movement Flow Rate	56	161	530	183	749	515
Number of Lanes	1	0	1	1	0	1

Major/Minor			Major 1			Major 2
Conflicting Flow Rate - All	2635	357	0	0	713	0
Stage 1	622	-	-	-	-	-
Stage 2	2013	-	-	-	-	-
Follow-up Headway	3.554	3.363	-	-	2.218	-
Pot Capacity-1 Maneuver	# 25	676	-	-	887	-
Stage 1	528	-	-	-	-	-
Stage 2	110	-	-	-	-	-
Time blocked-Platoon(%)	0	0	-	-	0	-
Mov Capacity-1 Maneuver	# 25	676	-	-	887	-
Mov Capacity-2 Maneuver	# 25	-	-	-	-	-
Stage 1	528	-	-	-	-	-
Stage 2	110	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay (s)	$ 744.4	0	15.8
HCM LOS	F	A	C

Lane	NBT	NBR	WBLn1	SBL	SBT
Capacity (vph)			90		
HCM Control Delay (s)	-	-	$ 744.4	26.698	-
HCM Lane VC Ratio	-	-	2.416	0.845	-
HCM Lane LOS	-	-	F	D	-
HCM 95th Percentile Queue (veh)	-	-	20.007	10.239	-

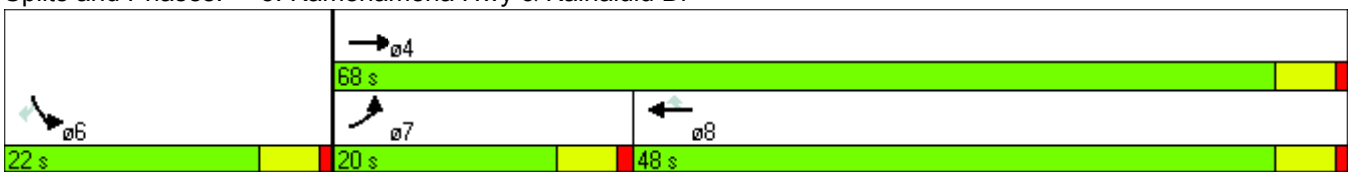
Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	455	581	631	250	186	497
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)	300			400	0	0
Storage Lanes	2			1	1	1
Taper Length (ft)	100				100	
Satd. Flow (prot)	3433	1845	1810	1495	1736	1509
Flt Permitted	0.950				0.950	
Satd. Flow (perm)	3433	1845	1810	1495	1736	1509
Right Turn on Red				Yes		Yes
Satd. Flow (RTOR)				272		405
Link Speed (mph)		45	45		30	
Link Distance (ft)		500	3000		500	
Travel Time (s)		7.6	45.5		11.4	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	2%	3%	5%	8%	4%	7%
Shared Lane Traffic (%)						
Lane Group Flow (vph)	495	632	686	272	202	540
Turn Type	Prot	NA	NA	Perm	NA	Perm
Protected Phases	7	4	8		6	
Permitted Phases				8		6
Detector Phase	7	4	8	8	6	6
Switch Phase						
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	10.0	22.0	22.0	22.0	22.0	22.0
Total Split (s)	20.0	68.0	48.0	48.0	22.0	22.0
Total Split (%)	22.2%	75.6%	53.3%	53.3%	24.4%	24.4%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead		Lag	Lag		
Lead-Lag Optimize?						
Recall Mode	None	None	None	None	Max	Max
Act Effct Green (s)	14.5	55.6	36.0	36.0	17.2	17.2
Actuated g/C Ratio	0.17	0.67	0.43	0.43	0.21	0.21
v/c Ratio	0.82	0.51	0.87	0.34	0.56	0.85
Control Delay	47.2	8.3	34.5	3.0	38.5	24.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	47.2	8.3	34.5	3.0	38.5	24.1
LOS	D	A	C	A	D	C
Approach Delay		25.4	25.6		28.1	
Approach LOS		C	C		C	
Queue Length 50th (ft)	135	140	315	0	101	66
Queue Length 95th (ft)	#226	208	469	40	179	#272
Internal Link Dist (ft)		420	2920		420	
Turn Bay Length (ft)	300			400		
Base Capacity (vph)	627	1416	948	912	359	633
Starvation Cap Reductn	0	0	0	0	0	0

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.79	0.45	0.72	0.30	0.56	0.85

Intersection Summary

Area Type: Other
Cycle Length: 90
Actuated Cycle Length: 82.9
Natural Cycle: 80
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.87
Intersection Signal Delay: 26.1 Intersection LOS: C
Intersection Capacity Utilization 72.3% ICU Level of Service C
Analysis Period (min) 15
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 3: Kamehameha Hwy & Kaihalulu Dr



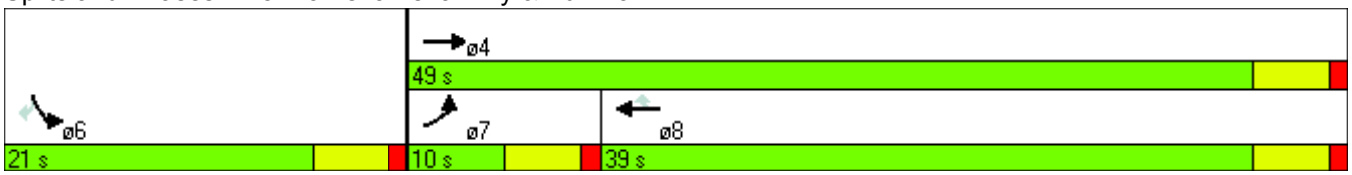
Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	183	584	694	338	219	187
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)	200			400	0	0
Storage Lanes	2			1	1	1
Taper Length (ft)	100				100	
Satd. Flow (prot)	3406	1815	1781	1471	1715	1503
Flt Permitted	0.950				0.950	
Satd. Flow (perm)	3406	1815	1781	1446	1703	1482
Right Turn on Red				Yes		Yes
Satd. Flow (RTOR)				367		203
Link Speed (mph)		45	45		25	
Link Distance (ft)		500	5500		500	
Travel Time (s)		7.6	83.3		13.6	
Confl. Peds. (#/hr)					3	1
Confl. Bikes (#/hr)				12		1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	2%	3%	5%	8%	4%	7%
Bus Blockages (#/hr)	4	4	4	4	3	1
Shared Lane Traffic (%)						
Lane Group Flow (vph)	199	635	754	367	238	203
Turn Type	Prot	NA	NA	Perm	NA	Perm
Protected Phases	7	4	8		6	
Permitted Phases				8		6
Detector Phase	7	4	8	8	6	6
Switch Phase						
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	9.0	21.0	21.0	21.0	21.0	21.0
Total Split (s)	10.0	49.0	39.0	39.0	21.0	21.0
Total Split (%)	14.3%	70.0%	55.7%	55.7%	30.0%	30.0%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead		Lag	Lag		
Lead-Lag Optimize?						
Recall Mode	None	None	None	None	Min	Min
Act Effct Green (s)	5.1	40.7	30.5	30.5	13.2	13.2
Actuated g/C Ratio	0.08	0.64	0.48	0.48	0.21	0.21
v/c Ratio	0.74	0.55	0.89	0.42	0.68	0.44
Control Delay	49.9	9.1	30.6	2.9	34.7	7.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	49.9	9.1	30.6	2.9	34.7	7.2
LOS	D	A	C	A	C	A
Approach Delay		18.9	21.5		22.0	
Approach LOS		B	C		C	
Queue Length 50th (ft)	43	126	260	0	92	0
Queue Length 95th (ft)	#97	217	#493	39	162	48
Internal Link Dist (ft)		420	5420		420	

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Turn Bay Length (ft)	200			400		
Base Capacity (vph)	270	1270	963	950	436	528
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.74	0.50	0.78	0.39	0.55	0.38

Intersection Summary

Area Type: Other
Cycle Length: 70
Actuated Cycle Length: 64
Natural Cycle: 65
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.89
Intersection Signal Delay: 20.7 Intersection LOS: C
Intersection Capacity Utilization 66.4% ICU Level of Service C
Analysis Period (min) 15
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 5: Kamehameha Hwy & Kuilima Dr



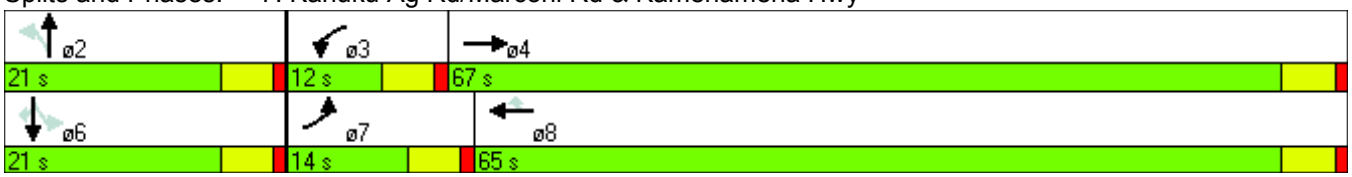
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	94	685	24	28	911	95	24	0	20	88	0	97
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	200		0	330		400	0		0	0		200
Storage Lanes	1		0	1		1	0		0	0		1
Taper Length (ft)	100			100			100			100		
Satd. Flow (prot)	1805	1655	0	1203	1792	1615	0	1157	0	0	1805	1615
Flt Permitted	0.950			0.950				0.796			0.726	
Satd. Flow (perm)	1805	1655	0	1203	1792	1573	0	946	0	0	1379	1615
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		3				103		76				105
Link Speed (mph)		45			45			30			25	
Link Distance (ft)		500			1200			500			500	
Travel Time (s)		7.6			18.2			11.4			13.6	
Confl. Bikes (#/hr)						10						
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	0%	13%	50%	50%	6%	0%	50%	2%	50%	0%	2%	0%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	102	771	0	30	990	103	0	48	0	0	96	105
Turn Type	Prot	NA		Prot	NA	Perm	Perm	NA		Perm	NA	Perm
Protected Phases	7	4		3	8			2			6	
Permitted Phases						8	2			6		6
Detector Phase	7	4		3	8	8	2	2		6	6	6
Switch Phase												
Minimum Initial (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Minimum Split (s)	9.0	21.0		9.0	21.0	21.0	21.0	21.0		21.0	21.0	21.0
Total Split (s)	14.0	67.0		12.0	65.0	65.0	21.0	21.0		21.0	21.0	21.0
Total Split (%)	14.0%	67.0%		12.0%	65.0%	65.0%	21.0%	21.0%		21.0%	21.0%	21.0%
Yellow Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
All-Red Time (s)	1.0	1.0		1.0	1.0	1.0	1.0	1.0		1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0		0.0	0.0	0.0		0.0			0.0	0.0
Total Lost Time (s)	5.0	5.0		5.0	5.0	5.0		5.0			5.0	5.0
Lead/Lag	Lead	Lag		Lead	Lag	Lag						
Lead-Lag Optimize?												
Recall Mode	None	None		None	None	None	Min	Min		Min	Min	Min
Act Effct Green (s)	8.8	57.1		6.8	53.1	53.1		11.1			11.1	11.1
Actuated g/C Ratio	0.10	0.67		0.08	0.62	0.62		0.13			0.13	0.13
v/c Ratio	0.55	0.69		0.31	0.89	0.10		0.25			0.54	0.35
Control Delay	54.0	14.6		52.0	26.7	2.0		7.0			50.3	11.6
Queue Delay	0.0	0.0		0.0	0.0	0.0		0.0			0.0	0.0
Total Delay	54.0	14.6		52.0	26.7	2.0		7.0			50.3	11.6
LOS	D	B		D	C	A		A			D	B
Approach Delay		19.2			25.1			7.0			30.1	
Approach LOS		B			C			A			C	
Queue Length 50th (ft)	60	272		18	449	0		0			56	0
Queue Length 95th (ft)	#134	483		49	#845	20		16			108	46
Internal Link Dist (ft)		420			1120			420			420	
Turn Bay Length (ft)	200			330		400						200
Base Capacity (vph)	203	1217		105	1282	1154		250			276	407

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Starvation Cap Reductn	0	0		0	0	0		0			0	0
Spillback Cap Reductn	0	0		0	0	0		0			0	0
Storage Cap Reductn	0	0		0	0	0		0			0	0
Reduced v/c Ratio	0.50	0.63		0.29	0.77	0.09		0.19			0.35	0.26

Intersection Summary

Area Type: Other
Cycle Length: 100
Actuated Cycle Length: 85.1
Natural Cycle: 90
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.89
Intersection Signal Delay: 22.9 Intersection LOS: C
Intersection Capacity Utilization 74.9% ICU Level of Service D
Analysis Period (min) 15
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 7: Kahuku Ag Rd/Marconi Rd & Kamehameha Hwy



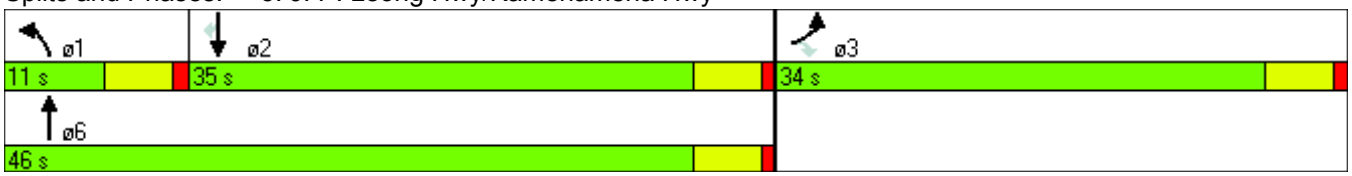
Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	561	18	43	676	596	646
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0	0	0			450
Storage Lanes	1	1	1			1
Taper Length (ft)	100		100			
Satd. Flow (prot)	1787	1615	1805	1900	1810	1583
Flt Permitted	0.950		0.950			
Satd. Flow (perm)	1787	1615	1805	1900	1810	1583
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)		95				687
Link Speed (mph)	30			30	30	
Link Distance (ft)	220			382	754	
Travel Time (s)	5.0			8.7	17.1	
Peak Hour Factor	0.95	0.64	0.60	1.00	1.00	0.94
Heavy Vehicles (%)	1%	0%	0%	0%	5%	2%
Shared Lane Traffic (%)						
Lane Group Flow (vph)	591	28	72	676	596	687
Turn Type	NA	Perm	Prot	NA	NA	Perm
Protected Phases	3		1	6	2	
Permitted Phases		3				2
Detector Phase	3	3	1	6	2	2
Switch Phase						
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	21.0	21.0	9.0	9.0	21.0	21.0
Total Split (s)	34.0	34.0	11.0	46.0	35.0	35.0
Total Split (%)	42.5%	42.5%	13.8%	57.5%	43.8%	43.8%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag			Lead		Lag	Lag
Lead-Lag Optimize?						
Recall Mode	None	None	None	None	Max	Max
Act Effct Green (s)	27.2	27.2	6.0	38.7	30.4	30.4
Actuated g/C Ratio	0.36	0.36	0.08	0.51	0.40	0.40
v/c Ratio	0.92	0.04	0.51	0.70	0.83	0.66
Control Delay	47.1	0.1	49.4	19.3	34.2	5.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	47.1	0.1	49.4	19.3	34.2	5.1
LOS	D	A	D	B	C	A
Approach Delay	45.0			22.2	18.6	
Approach LOS	D			C	B	
Queue Length 50th (ft)	276	0	35	241	272	0
Queue Length 95th (ft)	#474	0	50	366	#464	68
Internal Link Dist (ft)	140			302	674	
Turn Bay Length (ft)						450
Base Capacity (vph)	689	681	144	1035	722	1044
Starvation Cap Reductn	0	0	0	0	0	0

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.86	0.04	0.50	0.65	0.83	0.66

Intersection Summary

Area Type: Other
Cycle Length: 80
Actuated Cycle Length: 76.1
Natural Cycle: 80
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.92
Intersection Signal Delay: 25.8 Intersection LOS: C
Intersection Capacity Utilization 75.1% ICU Level of Service D
Analysis Period (min) 15
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 3: J. P. Leong Hwy/Kamehameha Hwy



Intersection	
Intersection Delay (sec/veh):	106.2

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Volume (vph)	61	347	920	77	116	875
Conflicting Peds.(#/hr)	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
Right Turn Channelized	Yield	Yield	Yield	Yield	None	None
Storage Length	0	0		200	0	
Median Width	12		0			0
Grade (%)	0%		0%			0%
Peak Hour Factor	0.95	0.99	0.96	0.84	1.00	0.99
Heavy Vehicles(%)	6	5	3	5	3	2
Movement Flow Rate	64	351	958	92	116	884
Number of Lanes	1	0	1	1	0	1

Major/Minor			Major 1			Major 2
Conflicting Flow Rate - All	2120	525	0	0	1050	0
Stage 1	1004	-	-	-	-	-
Stage 2	1116	-	-	-	-	-
Follow-up Headway	3.554	3.345	-	-	2.227	-
Pot Capacity-1 Maneuver	# 54	547	-	-	659	-
Stage 1	348	-	-	-	-	-
Stage 2	308	-	-	-	-	-
Time blocked-Platoon(%)	0	0	-	-	0	-
Mov Capacity-1 Maneuver	# 35	547	-	-	659	-
Mov Capacity-2 Maneuver	# 35	-	-	-	-	-
Stage 1	348	-	-	-	-	-
Stage 2	201	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay (s)	$ 627.7	0	1.3
HCM LOS	F	A	A

Lane	NBT	NBR	WBLn1	SBL	SBT
Capacity (vph)			183		
HCM Control Delay (s)	-	-	$ 627.7	11.626	-
HCM Lane VC Ratio	-	-	2.266	0.176	-
HCM Lane LOS	-	-	F	B	-
HCM 95th Percentile Queue (veh)	-	-	33.594	0.635	-

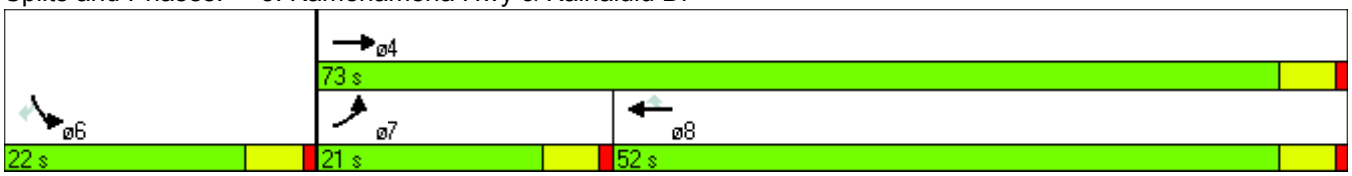
Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	418	677	748	190	197	461
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)	300			400	0	0
Storage Lanes	2			1	1	1
Taper Length (ft)	100				100	
Satd. Flow (prot)	3400	1863	1810	1553	1752	1583
Flt Permitted	0.950				0.950	
Satd. Flow (perm)	3400	1863	1810	1553	1752	1583
Right Turn on Red				Yes		Yes
Satd. Flow (RTOR)				207		370
Link Speed (mph)		45	45		30	
Link Distance (ft)		500	3000		500	
Travel Time (s)		7.6	45.5		11.4	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	3%	2%	5%	4%	3%	2%
Shared Lane Traffic (%)						
Lane Group Flow (vph)	454	736	813	207	214	501
Turn Type	Prot	NA	NA	Perm	NA	Perm
Protected Phases	7	4	8		6	
Permitted Phases				8		6
Detector Phase	7	4	8	8	6	6
Switch Phase						
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	10.0	22.0	22.0	22.0	22.0	22.0
Total Split (s)	21.0	73.0	52.0	52.0	22.0	22.0
Total Split (%)	22.1%	76.8%	54.7%	54.7%	23.2%	23.2%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead		Lag	Lag		
Lead-Lag Optimize?						
Recall Mode	None	None	None	None	Max	Max
Act Effct Green (s)	15.2	64.0	43.8	43.8	17.1	17.1
Actuated g/C Ratio	0.17	0.70	0.48	0.48	0.19	0.19
v/c Ratio	0.80	0.56	0.94	0.24	0.65	0.84
Control Delay	49.1	8.5	42.0	2.7	46.3	24.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	49.1	8.5	42.0	2.7	46.3	24.6
LOS	D	A	D	A	D	C
Approach Delay		24.0	34.0		31.1	
Approach LOS		C	C		C	
Queue Length 50th (ft)	137	178	430	0	122	74
Queue Length 95th (ft)	#206	259	#688	35	#214	#259
Internal Link Dist (ft)		420	2920		420	
Turn Bay Length (ft)	300			400		
Base Capacity (vph)	600	1398	938	905	328	597
Starvation Cap Reductn	0	0	0	0	0	0

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.76	0.53	0.87	0.23	0.65	0.84

Intersection Summary

Area Type: Other
Cycle Length: 95
Actuated Cycle Length: 91.2
Natural Cycle: 90
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.94
Intersection Signal Delay: 29.2 Intersection LOS: C
Intersection Capacity Utilization 76.2% ICU Level of Service D
Analysis Period (min) 15
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 3: Kamehameha Hwy & Kaihalulu Dr



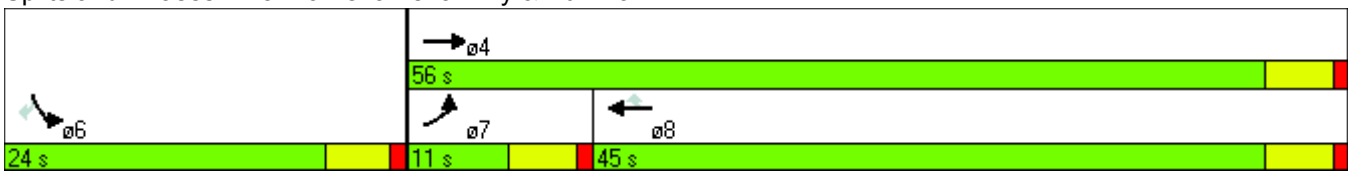
Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	191	683	729	277	282	209
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)	200			400	0	0
Storage Lanes	2			1	1	1
Taper Length (ft)	100				100	
Satd. Flow (prot)	3386	1848	1795	1540	1738	1571
Flt Permitted	0.950				0.950	
Satd. Flow (perm)	3386	1848	1795	1514	1738	1550
Right Turn on Red				Yes		Yes
Satd. Flow (RTOR)				301		227
Link Speed (mph)		45	45		25	
Link Distance (ft)		500	5500		500	
Travel Time (s)		7.6	83.3		13.6	
Confl. Bikes (#/hr)				12		1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	3%	2%	5%	4%	3%	2%
Bus Blockages (#/hr)	2	2	2	2	2	2
Shared Lane Traffic (%)						
Lane Group Flow (vph)	208	742	792	301	307	227
Turn Type	Prot	NA	NA	Perm	NA	Perm
Protected Phases	7	4	8		6	
Permitted Phases				8		6
Detector Phase	7	4	8	8	6	6
Switch Phase						
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	9.0	21.0	21.0	21.0	21.0	21.0
Total Split (s)	11.0	56.0	45.0	45.0	24.0	24.0
Total Split (%)	13.8%	70.0%	56.3%	56.3%	30.0%	30.0%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead		Lag	Lag		
Lead-Lag Optimize?						
Recall Mode	None	None	None	None	Min	Min
Act Effct Green (s)	6.1	47.2	36.0	36.0	16.7	16.7
Actuated g/C Ratio	0.08	0.64	0.49	0.49	0.23	0.23
v/c Ratio	0.75	0.63	0.91	0.34	0.79	0.43
Control Delay	53.8	11.4	34.1	2.6	43.7	6.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	53.8	11.4	34.1	2.6	43.7	6.8
LOS	D	B	C	A	D	A
Approach Delay		20.7	25.4		28.0	
Approach LOS		C	C		C	
Queue Length 50th (ft)	54	198	335	0	142	0
Queue Length 95th (ft)	#110	305	#575	37	#257	53
Internal Link Dist (ft)		420	5420		420	
Turn Bay Length (ft)	200			400		

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Base Capacity (vph)	279	1295	986	967	453	572
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.75	0.57	0.80	0.31	0.68	0.40

Intersection Summary	
Area Type: Other	
Cycle Length: 80	
Actuated Cycle Length: 74	
Natural Cycle: 70	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 0.91	
Intersection Signal Delay: 24.2	Intersection LOS: C
Intersection Capacity Utilization 71.9%	ICU Level of Service C
Analysis Period (min) 15	

\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 5: Kamehameha Hwy & Kuilima Dr



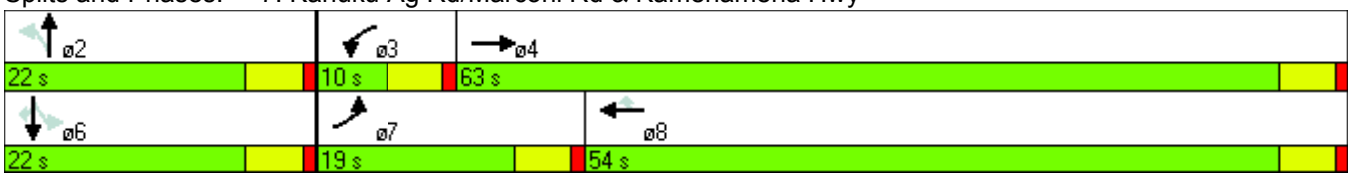
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	169	778	18	18	825	138	16	0	16	130	0	165
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	200		0	330		400	0		0	0		200
Storage Lanes	1		0	1		1	0		0	0		1
Taper Length (ft)	100			100			100			100		
Satd. Flow (prot)	1805	1664	0	1203	1792	1615	0	1152	0	0	1805	1615
Flt Permitted	0.950			0.950				0.823			0.735	
Satd. Flow (perm)	1805	1664	0	1203	1792	1571	0	972	0	0	1396	1615
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		2				150		138				179
Link Speed (mph)		45			45			30			25	
Link Distance (ft)		500			1200			500			500	
Travel Time (s)		7.6			18.2			11.4			13.6	
Confl. Bikes (#/hr)						10						
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	0%	13%	50%	50%	6%	0%	50%	2%	50%	0%	2%	0%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	184	866	0	20	897	150	0	34	0	0	141	179
Turn Type	Prot	NA		Prot	NA	Perm	Perm	NA		Perm	NA	Perm
Protected Phases	7	4		3	8			2			6	
Permitted Phases						8	2			6		6
Detector Phase	7	4		3	8	8	2	2		6	6	6
Switch Phase												
Minimum Initial (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Minimum Split (s)	9.0	21.0		9.0	21.0	21.0	21.0	21.0		21.0	21.0	21.0
Total Split (s)	19.0	63.0		10.0	54.0	54.0	22.0	22.0		22.0	22.0	22.0
Total Split (%)	20.0%	66.3%		10.5%	56.8%	56.8%	23.2%	23.2%		23.2%	23.2%	23.2%
Yellow Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
All-Red Time (s)	1.0	1.0		1.0	1.0	1.0	1.0	1.0		1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0		0.0	0.0	0.0		0.0			0.0	0.0
Total Lost Time (s)	5.0	5.0		5.0	5.0	5.0		5.0			5.0	5.0
Lead/Lag	Lead	Lag		Lead	Lag	Lag						
Lead-Lag Optimize?												
Recall Mode	None	None		None	None	None	Min	Min		Min	Min	Min
Act Effct Green (s)	12.6	60.8		5.1	46.8	46.8		13.4			13.4	13.4
Actuated g/C Ratio	0.14	0.69		0.06	0.53	0.53		0.15			0.15	0.15
v/c Ratio	0.71	0.75		0.29	0.94	0.17		0.13			0.67	0.45
Control Delay	53.9	16.7		54.1	39.9	2.6		1.0			51.9	9.5
Queue Delay	0.0	0.0		0.0	0.0	0.0		0.0			0.0	0.0
Total Delay	53.9	16.7		54.1	39.9	2.6		1.0			51.9	9.5
LOS	D	B		D	D	A		A			D	A
Approach Delay		23.2			34.9			1.0			28.2	
Approach LOS		C			C			A			C	
Queue Length 50th (ft)	103	232		12	468	0		0			78	0
Queue Length 95th (ft)	#197	#683		36	#781	29		0			141	56
Internal Link Dist (ft)		420			1120			420			420	
Turn Bay Length (ft)	200			330		400						200
Base Capacity (vph)	291	1178		69	1010	950		301			273	459

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Starvation Cap Reductn	0	0		0	0	0		0			0	0
Spillback Cap Reductn	0	0		0	0	0		0			0	0
Storage Cap Reductn	0	0		0	0	0		0			0	0
Reduced v/c Ratio	0.63	0.74		0.29	0.89	0.16		0.11			0.52	0.39

Intersection Summary

Area Type: Other
Cycle Length: 95
Actuated Cycle Length: 88.1
Natural Cycle: 90
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.94
Intersection Signal Delay: 28.6 Intersection LOS: C
Intersection Capacity Utilization 78.0% ICU Level of Service D
Analysis Period (min) 15
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 7: Kahuku Ag Rd/Marconi Rd & Kamehameha Hwy



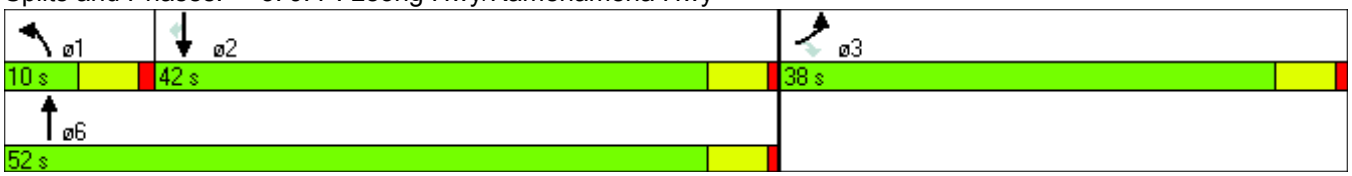
Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	608	64	45	738	666	593
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0	0	0			450
Storage Lanes	1	1	1			1
Taper Length (ft)	100		100			
Satd. Flow (prot)	1787	1615	1805	1845	1881	1583
Flt Permitted	0.950		0.950			
Satd. Flow (perm)	1787	1615	1805	1845	1881	1583
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)		91				659
Link Speed (mph)	30			30	30	
Link Distance (ft)	220			382	754	
Travel Time (s)	5.0			8.7	17.1	
Peak Hour Factor	1.00	0.70	1.00	0.89	0.90	0.90
Heavy Vehicles (%)	1%	0%	0%	3%	1%	2%
Shared Lane Traffic (%)						
Lane Group Flow (vph)	608	91	45	829	740	659
Turn Type	NA	Perm	Prot	NA	NA	Perm
Protected Phases	3		1	6	2	
Permitted Phases		3				2
Detector Phase	3	3	1	6	2	2
Switch Phase						
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	21.0	21.0	9.0	9.0	21.0	21.0
Total Split (s)	38.0	38.0	10.0	52.0	42.0	42.0
Total Split (%)	42.2%	42.2%	11.1%	57.8%	46.7%	46.7%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag			Lead		Lag	Lag
Lead-Lag Optimize?						
Recall Mode	None	None	None	None	Max	Max
Act Effct Green (s)	31.1	31.1	5.0	43.4	37.8	37.8
Actuated g/C Ratio	0.37	0.37	0.06	0.51	0.45	0.45
v/c Ratio	0.93	0.14	0.42	0.88	0.88	0.62
Control Delay	48.8	5.1	53.1	30.9	37.6	4.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	48.8	5.1	53.1	30.9	37.6	4.4
LOS	D	A	D	C	D	A
Approach Delay	43.1			32.0	22.0	
Approach LOS	D			C	C	
Queue Length 50th (ft)	327	0	25	387	399	0
Queue Length 95th (ft)	#540	15	#64	#625	#639	64
Internal Link Dist (ft)	140			302	674	
Turn Bay Length (ft)						450
Base Capacity (vph)	702	689	107	1032	840	1071
Starvation Cap Reductn	0	0	0	0	0	0

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.87	0.13	0.42	0.80	0.88	0.62

Intersection Summary

Area Type: Other
Cycle Length: 90
Actuated Cycle Length: 84.6
Natural Cycle: 90
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.93
Intersection Signal Delay: 29.9 Intersection LOS: C
Intersection Capacity Utilization 80.9% ICU Level of Service D
Analysis Period (min) 15
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 3: J. P. Leong Hwy/Kamehameha Hwy



Intersection	
Intersection Delay (sec/veh):	218.6

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Volume (vph)	56	347	997	92	104	958
Conflicting Peds.(#/hr)	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
Right Turn Channelized	Yield	Yield	Yield	Yield	None	None
Storage Length	0	0		200	0	
Median Width	12		0			0
Grade (%)	0%		0%			0%
Peak Hour Factor	1.00	1.00	0.91	0.79	0.80	0.95
Heavy Vehicles(%)	7	2	2	6	4	3
Movement Flow Rate	56	347	1096	116	130	1008
Number of Lanes	1	0	1	1	0	1

Major/Minor			Major 1			Major 2
Conflicting Flow Rate - All	2422	606	0	0	1212	0
Stage 1	1154	-	-	-	-	-
Stage 2	1268	-	-	-	-	-
Follow-up Headway	3.563	3.318	-	-	2.236	-
Pot Capacity-1 Maneuver	# 34	497	-	-	569	-
Stage 1	294	-	-	-	-	-
Stage 2	258	-	-	-	-	-
Time blocked-Platoon(%)	0	0	-	-	0	-
Mov Capacity-1 Maneuver	# 16	497	-	-	569	-
Mov Capacity-2 Maneuver	# 16	-	-	-	-	-
Stage 1	294	-	-	-	-	-
Stage 2	124	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay (s)	$ 1489.2	0	1.5
HCM LOS	F	A	A

Lane	NBT	NBR	WBLn1	SBL	SBT
Capacity (vph)			98		
HCM Control Delay (s)	-	-	$ 1489.2	13.19	-
HCM Lane VC Ratio	-	-	4.112	0.228	-
HCM Lane LOS	-	-	F	B	-
HCM 95th Percentile Queue (veh)	-	-	41.745	0.874	-

HCS+: Two-Lane Highways Release 5.4

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Two-Way Two-Lane Highway Segment Analysis

Analyst	RSO
Agency/Co.	Traffic Management Consultant
Date Performed	11/3/11
Analysis Time Period	AM Peak Hour W/FBO Alternative
Highway	Kamehameha Highway
From/To	West of Kaihalulu Drive
Jurisdiction	
Analysis Year	2025
Description	Turtle Bay Resort Master Plan

Input Data

Highway class	Class 1				
Shoulder width	6.0	ft	Peak-hour factor, PHF	0.92	
Lane width	12.0	ft	% Trucks and buses	8	%
Segment length	0.0	mi	% Recreational vehicles	0	%
Terrain type	Level		% No-passing zones	50	%
Grade: Length		mi	Access points/mi	2	/mi
Up/down		%			

Two-way hourly volume, V	1717	veh/h	
Directional split	50 / 50	%	

Average Travel Speed

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.1	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor,	0.992	
Two-way flow rate,(note-1) vp	1881	pc/h
Highest directional split proportion (note-2)	941	pc/h

Free-Flow Speed from Field Measurement:		
Field measured speed, SFM	-	mi/h
Observed volume, Vf	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed, BFFS	45.0	mi/h
Adj. for lane and shoulder width, fLS	0.0	mi/h
Adj. for access points, fA	0.5	mi/h
Free-flow speed, FFS	44.5	mi/h

Adjustment for no-passing zones, fnp	0.8	mi/h
Average travel speed, ATS	29.1	mi/h

Percent Time-Spent-Following

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.0	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor, fHV	1.000	
Two-way flow rate,(note-1) vp	1866	pc/h
Highest directional split proportion (note-2)	933	
Base percent time-spent-following, BPTSF	80.6	%
Adj.for directional distribution and no-passing zones, fd/np	3.9	
Percent time-spent-following, PTSF	84.5	%

Level of Service and Other Performance Measures

Level of service, LOS	E	
Volume to capacity ratio, v/c	0.59	
Peak 15-min vehicle-miles of travel, VMT15	0	veh-mi
Peak-hour vehicle-miles of travel, VMT60	0	veh-mi
Peak 15-min total travel time, TT15	0.0	veh-h

Notes:
1. If vp >= 3200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split vp >= 1700 pc/h, terminate analysis-the LOS is F.

HCS+: Two-Lane Highways Release 5.4

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Two-Way Two-Lane Highway Segment Analysis

Analyst	RSO
Agency/Co.	Traffic Management Consultant
Date Performed	11/1/2011
Analysis Time Period	AM Peak Hour W/FBO Alt.
Highway	Kamehameha Highway
From/To	Haleiwa to Kawailoa
Jurisdiction	
Analysis Year	2025
Description	Turtle Bay Resort Master Plan

Input Data

Highway class	Class 1				
Shoulder width	6.0	ft	Peak-hour factor, PHF	0.94	
Lane width	12.0	ft	% Trucks and buses	5	%
Segment length	0.0	mi	% Recreational vehicles	0	%
Terrain type	Level		% No-passing zones	80	%
Grade: Length		mi	Access points/mi	2	/mi
Up/down		%			

Two-way hourly volume, V	1865	veh/h	
Directional split	51 / 49	%	

Average Travel Speed

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.1	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor,	0.995	
Two-way flow rate,(note-1) vp	1994	pc/h
Highest directional split proportion (note-2)	1017	pc/h
Free-Flow Speed from Field Measurement:		
Field measured speed, SFM	-	mi/h
Observed volume, Vf	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed, BFFS	45.0	mi/h
Adj. for lane and shoulder width, fLS	0.0	mi/h
Adj. for access points, fA	0.5	mi/h
Free-flow speed, FFS	44.5	mi/h
Adjustment for no-passing zones, fnp	1.0	mi/h

Average travel speed, ATS 28.0 mi/h

Percent Time-Spent-Following

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.0	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor, fHV	1.000	
Two-way flow rate,(note-1) vp	1984	pc/h
Highest directional split proportion (note-2)	1012	
Base percent time-spent-following, BPTSF	82.5	%
Adj.for directional distribution and no-passing zones, fd/np	4.2	
Percent time-spent-following, PTSF	86.7	%

Level of Service and Other Performance Measures

Level of service, LOS	E	
Volume to capacity ratio, v/c	0.62	
Peak 15-min vehicle-miles of travel, VMT15	0	veh-mi
Peak-hour vehicle-miles of travel, VMT60	0	veh-mi
Peak 15-min total travel time, TT15	0.0	veh-h

Notes:
1. If vp >= 3200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split vp >= 1700 pc/h, terminate analysis-the LOS is F.

HCS+: Two-Lane Highways Release 5.4

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Two-Way Two-Lane Highway Segment Analysis

Analyst	RSO
Agency/Co.	Traffic Management Consultant
Date Performed	11/1/2011
Analysis Time Period	AM Peak Hour W/FBO Alternative
Highway	Kamehameha Highway
From/To	Hygienic Store
Jurisdiction	
Analysis Year	2025
Description	Turtle Bay Resort Master Plan

Input Data

Highway class	Class 1				
Shoulder width	6.0	ft	Peak-hour factor, PHF	0.89	
Lane width	12.0	ft	% Trucks and buses	3	%
Segment length	0.0	mi	% Recreational vehicles	0	%
Terrain type	Level		% No-passing zones	80	%
Grade: Length		mi	Access points/mi	10	/mi
Up/down		%			

Two-way hourly volume, V	1735	veh/h	
Directional split	63 / 37	%	

Average Travel Speed

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.1	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor,	0.997	
Two-way flow rate,(note-1) vp	1955	pc/h
Highest directional split proportion (note-2)	1232	pc/h
Free-Flow Speed from Field Measurement:		
Field measured speed, SFM	-	mi/h
Observed volume, Vf	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed, BFFS	45.0	mi/h
Adj. for lane and shoulder width, fLS	0.0	mi/h
Adj. for access points, fA	2.5	mi/h
Free-flow speed, FFS	42.5	mi/h
Adjustment for no-passing zones, fnp	1.0	mi/h

Average travel speed, ATS 26.3 mi/h

Percent Time-Spent-Following

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.0	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor, fHV	1.000	
Two-way flow rate,(note-1) vp	1949	pc/h
Highest directional split proportion (note-2)	1228	
Base percent time-spent-following, BPTSF	82.0	%
Adj.for directional distribution and no-passing zones, fd/np	4.3	
Percent time-spent-following, PTSF	86.3	%

Level of Service and Other Performance Measures

Level of service, LOS	E	
Volume to capacity ratio, v/c	0.61	
Peak 15-min vehicle-miles of travel, VMT15	0	veh-mi
Peak-hour vehicle-miles of travel, VMT60	0	veh-mi
Peak 15-min total travel time, TT15	0.0	veh-h

Notes:
1. If vp >= 3200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split vp >= 1700 pc/h, terminate analysis-the LOS is F.

HCS+: Two-Lane Highways Release 5.4

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Two-Way Two-Lane Highway Segment Analysis

Analyst	RSO
Agency/Co.	Traffic Management Consultant
Date Performed	11/3/11
Analysis Time Period	PM Peak Hour W/FBO Alternative
Highway	Kamehameha Highway
From/To	West of Kaihalulu Drive
Jurisdiction	
Analysis Year	2025
Description	Turtle Bay Resort Master Plan

Input Data

Highway class	Class 1				
Shoulder width	6.0	ft	Peak-hour factor, PHF	0.92	
Lane width	12.0	ft	% Trucks and buses	4	%
Segment length	0.0	mi	% Recreational vehicles	0	%
Terrain type	Level		% No-passing zones	50	%
Grade: Length		mi	Access points/mi	2	/mi
Up/down		%			

Two-way hourly volume, V	2154	veh/h	
Directional split	52 / 48	%	

Average Travel Speed

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.1	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor,	0.996	
Two-way flow rate,(note-1) vp	2351	pc/h
Highest directional split proportion (note-2)	1223	pc/h
Free-Flow Speed from Field Measurement:		
Field measured speed, SFM	-	mi/h
Observed volume, Vf	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed, BFFS	45.0	mi/h
Adj. for lane and shoulder width, fLS	0.0	mi/h
Adj. for access points, fA	0.5	mi/h
Free-flow speed, FFS	44.5	mi/h
Adjustment for no-passing zones, fnp	0.7	mi/h

Average travel speed, ATS 25.5 mi/h

Percent Time-Spent-Following

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.0	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor, fHV	1.000	
Two-way flow rate,(note-1) vp	2341	pc/h
Highest directional split proportion (note-2)	1217	
Base percent time-spent-following, BPTSF	87.2	%
Adj.for directional distribution and no-passing zones, fd/np	2.4	
Percent time-spent-following, PTSF	89.7	%

Level of Service and Other Performance Measures

Level of service, LOS	E	
Volume to capacity ratio, v/c	0.73	
Peak 15-min vehicle-miles of travel, VMT15	0	veh-mi
Peak-hour vehicle-miles of travel, VMT60	0	veh-mi
Peak 15-min total travel time, TT15	0.0	veh-h

Notes:
1. If vp >= 3200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split vp >= 1700 pc/h, terminate analysis-the LOS is F.

HCS+: Two-Lane Highways Release 5.4

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Two-Way Two-Lane Highway Segment Analysis

Analyst	RSO
Agency/Co.	Traffic Management Consultant
Date Performed	11/1/2011
Analysis Time Period	PM Peak Hour W/FBO Alt
Highway	Kamehameha Highway
From/To	Haleiwa to Kawailoa
Jurisdiction	
Analysis Year	2025
Description	Turtle Bay Resort Master Plan

Input Data

Highway class	Class 1				
Shoulder width	6.0	ft	Peak-hour factor, PHF	0.99	
Lane width	12.0	ft	% Trucks and buses	2	%
Segment length	0.0	mi	% Recreational vehicles	0	%
Terrain type	Level		% No-passing zones	80	%
Grade: Length		mi	Access points/mi	2	/mi
Up/down		%			

Two-way hourly volume, V	2479	veh/h	
Directional split	50 / 50	%	

Average Travel Speed

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.1	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor,	0.998	
Two-way flow rate,(note-1) vp	2509	pc/h
Highest directional split proportion (note-2)	1255	pc/h
Free-Flow Speed from Field Measurement:		
Field measured speed, SFM	-	mi/h
Observed volume, Vf	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed, BFFS	45.0	mi/h
Adj. for lane and shoulder width, fLS	0.0	mi/h
Adj. for access points, fA	0.5	mi/h
Free-flow speed, FFS	44.5	mi/h
Adjustment for no-passing zones, fnp	0.9	mi/h

Average travel speed, ATS 24.1 mi/h

Percent Time-Spent-Following

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.0	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor, fHV	1.000	
Two-way flow rate,(note-1) vp	2504	pc/h
Highest directional split proportion (note-2)	1252	
Base percent time-spent-following, BPTSF	88.9	%
Adj.for directional distribution and no-passing zones, fd/np	2.6	
Percent time-spent-following, PTSF	91.5	%

Level of Service and Other Performance Measures

Level of service, LOS	E	
Volume to capacity ratio, v/c	0.78	
Peak 15-min vehicle-miles of travel, VMT15	0	veh-mi
Peak-hour vehicle-miles of travel, VMT60	0	veh-mi
Peak 15-min total travel time, TT15	0.0	veh-h

Notes:
1. If vp >= 3200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split vp >= 1700 pc/h, terminate analysis-the LOS is F.

HCS+: Two-Lane Highways Release 5.4

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Two-Way Two-Lane Highway Segment Analysis

Analyst	RSO
Agency/Co.	Traffic Management Consultant
Date Performed	11/1/2011
Analysis Time Period	PM Peak Hour W/FBO Alternative
Highway	Kamehameha Highway
From/To	Hygienic Store
Jurisdiction	
Analysis Year	2025
Description	Turtle Bay Resort Master Plan

Input Data

Highway class	Class 1				
Shoulder width	6.0	ft	Peak-hour factor, PHF	0.99	
Lane width	12.0	ft	% Trucks and buses	5	%
Segment length	0.0	mi	% Recreational vehicles	0	%
Terrain type	Level		% No-passing zones	80	%
Grade: Length		mi	Access points/mi	10	/mi
Up/down		%			

Two-way hourly volume, V	2258	veh/h	
Directional split	56 / 44	%	

Average Travel Speed

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.1	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor,	0.995	
Two-way flow rate,(note-1) vp	2292	pc/h
Highest directional split proportion (note-2)	1284	pc/h
Free-Flow Speed from Field Measurement:		
Field measured speed, SFM	-	mi/h
Observed volume, Vf	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed, BFFS	45.0	mi/h
Adj. for lane and shoulder width, fLS	0.0	mi/h
Adj. for access points, fA	2.5	mi/h
Free-flow speed, FFS	42.5	mi/h
Adjustment for no-passing zones, fnp	0.9	mi/h

Average travel speed, ATS 23.8 mi/h

Percent Time-Spent-Following

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.0	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor, fHV	1.000	
Two-way flow rate,(note-1) vp	2281	pc/h
Highest directional split proportion (note-2)	1277	
Base percent time-spent-following, BPTSF	86.5	%
Adj.for directional distribution and no-passing zones, fd/np	3.2	
Percent time-spent-following, PTSF	89.7	%

Level of Service and Other Performance Measures

Level of service, LOS	E	
Volume to capacity ratio, v/c	0.72	
Peak 15-min vehicle-miles of travel, VMT15	0	veh-mi
Peak-hour vehicle-miles of travel, VMT60	0	veh-mi
Peak 15-min total travel time, TT15	0.0	veh-h

Notes:
1. If vp >= 3200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split vp >= 1700 pc/h, terminate analysis-the LOS is F.

HCS+: Two-Lane Highways Release 5.4

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Two-Way Two-Lane Highway Segment Analysis

Analyst	RSO
Agency/Co.	Traffic Management Consultant
Date Performed	11/5/11
Analysis Time Period	Sat Peak Hr W/FBO Alternative
Highway	Kamehameha Highway
From/To	West of Kaihalulu Drive
Jurisdiction	
Analysis Year	2025
Description	Turtle Bay Resort Master Plan

Input Data

Highway class	Class 1				
Shoulder width	6.0	ft	Peak-hour factor, PHF	0.92	
Lane width	12.0	ft	% Trucks and buses	3	%
Segment length	0.0	mi	% Recreational vehicles	0	%
Terrain type	Level		% No-passing zones	50	%
Grade: Length		mi	Access points/mi	2	/mi
Up/down		%			

Two-way hourly volume, V	2290	veh/h	
Directional split	53 / 47	%	

Average Travel Speed

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.1	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor,	0.997	
Two-way flow rate,(note-1) vp	2497	pc/h
Highest directional split proportion (note-2)	1323	pc/h
Free-Flow Speed from Field Measurement:		
Field measured speed, SFM	-	mi/h
Observed volume, Vf	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed, BFFS	45.0	mi/h
Adj. for lane and shoulder width, fLS	0.0	mi/h
Adj. for access points, fA	0.5	mi/h
Free-flow speed, FFS	44.5	mi/h
Adjustment for no-passing zones, fnp	0.7	mi/h

Average travel speed, ATS 24.4 mi/h

Percent Time-Spent-Following

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.0	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor, fHV	1.000	
Two-way flow rate,(note-1) vp	2489	pc/h
Highest directional split proportion (note-2)	1319	
Base percent time-spent-following, BPTSF	88.8	%
Adj.for directional distribution and no-passing zones, fd/np	2.1	
Percent time-spent-following, PTSF	90.8	%

Level of Service and Other Performance Measures

Level of service, LOS	E	
Volume to capacity ratio, v/c	0.78	
Peak 15-min vehicle-miles of travel, VMT15	0	veh-mi
Peak-hour vehicle-miles of travel, VMT60	0	veh-mi
Peak 15-min total travel time, TT15	0.0	veh-h

Notes:
1. If vp >= 3200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split vp >= 1700 pc/h, terminate analysis-the LOS is F.

HCS+: Two-Lane Highways Release 5.4

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Two-Way Two-Lane Highway Segment Analysis

Analyst	RSO
Agency/Co.	Traffic Management Consultant
Date Performed	10/29/2011
Analysis Time Period	Sat. Peak Hr W/FBO Alternative
Highway	Kamehameha Highway
From/To	Haleiwa to Kawailoa
Jurisdiction	
Analysis Year	2025
Description	Turtle Bay Resort Master Plan

Input Data

Highway class	Class 1				
Shoulder width	6.0	ft	Peak-hour factor, PHF	0.91	
Lane width	12.0	ft	% Trucks and buses	2	%
Segment length	0.0	mi	% Recreational vehicles	0	%
Terrain type	Level		% No-passing zones	80	%
Grade: Length		mi	Access points/mi	2	/mi
Up/down		%			

Two-way hourly volume, V	2574	veh/h	
Directional split	52 / 48	%	

Average Travel Speed

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.1	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor,	0.998	
Two-way flow rate,(note-1) vp	2834	pc/h
Highest directional split proportion (note-2)	1474	pc/h
Free-Flow Speed from Field Measurement:		
Field measured speed, SFM	-	mi/h
Observed volume, Vf	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed, BFFS	45.0	mi/h
Adj. for lane and shoulder width, fLS	0.0	mi/h
Adj. for access points, fA	0.5	mi/h
Free-flow speed, FFS	44.5	mi/h
Adjustment for no-passing zones, fnp	0.8	mi/h

Average travel speed, ATS 21.7 mi/h

Percent Time-Spent-Following

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.0	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor, fHV	1.000	
Two-way flow rate,(note-1) vp	2829	pc/h
Highest directional split proportion (note-2)	1471	
Base percent time-spent-following, BPTSF	91.7	%
Adj.for directional distribution and no-passing zones, fd/np	1.9	
Percent time-spent-following, PTSF	93.6	%

Level of Service and Other Performance Measures

Level of service, LOS	E	
Volume to capacity ratio, v/c	0.89	
Peak 15-min vehicle-miles of travel, VMT15	0	veh-mi
Peak-hour vehicle-miles of travel, VMT60	0	veh-mi
Peak 15-min total travel time, TT15	0.0	veh-h

Notes:
1. If vp >= 3200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split vp >= 1700 pc/h, terminate analysis-the LOS is F.

HCS+: Two-Lane Highways Release 5.4

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Two-Way Two-Lane Highway Segment Analysis

Analyst	RSO
Agency/Co.	Traffic Management Consultant
Date Performed	10/29/2011
Analysis Time Period	Sat Peak Hr W/FBO Alternative
Highway	Kamehameha Highway
From/To	Hygienic Store
Jurisdiction	
Analysis Year	2025
Description	Turtle Bay Resort Master Plan

Input Data

Highway class	Class 1				
Shoulder width	6.0	ft	Peak-hour factor, PHF	0.95	
Lane width	12.0	ft	% Trucks and buses	3	%
Segment length	0.0	mi	% Recreational vehicles	0	%
Terrain type	Level		% No-passing zones	80	%
Grade: Length		mi	Access points/mi	10	/mi
Up/down		%			

Two-way hourly volume, V	2389	veh/h	
Directional split	56 / 44	%	

Average Travel Speed

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.1	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor,	0.997	
Two-way flow rate,(note-1) vp	2522	pc/h
Highest directional split proportion (note-2)	1412	pc/h
Free-Flow Speed from Field Measurement:		
Field measured speed, SFM	-	mi/h
Observed volume, Vf	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed, BFFS	45.0	mi/h
Adj. for lane and shoulder width, fLS	0.0	mi/h
Adj. for access points, fA	2.5	mi/h
Free-flow speed, FFS	42.5	mi/h
Adjustment for no-passing zones, fnp	0.9	mi/h

Average travel speed, ATS 22.0 mi/h

Percent Time-Spent-Following

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.0	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor, fHV	1.000	
Two-way flow rate,(note-1) vp	2515	pc/h
Highest directional split proportion (note-2)	1408	
Base percent time-spent-following, BPTSF	89.0	%
Adj.for directional distribution and no-passing zones, fd/np	2.4	
Percent time-spent-following, PTSF	91.5	%

Level of Service and Other Performance Measures

Level of service, LOS	E	
Volume to capacity ratio, v/c	0.79	
Peak 15-min vehicle-miles of travel, VMT15	0	veh-mi
Peak-hour vehicle-miles of travel, VMT60	0	veh-mi
Peak 15-min total travel time, TT15	0.0	veh-h

Notes:
1. If vp >= 3200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split vp >= 1700 pc/h, terminate analysis-the LOS is F.

TRAFFIC IMPACT ANALYSIS REPORT

FOR THE PROPOSED

TURTLE BAY RESORT MASTER PLAN

KAHUKU, OAHU, HAWAII

APPENDIX E

CAPACITY ANALYSIS WORKSHEETS

2025 TRAFFIC CONDITIONS WITH RESORT RESIDENTIAL ALTERNATIVE

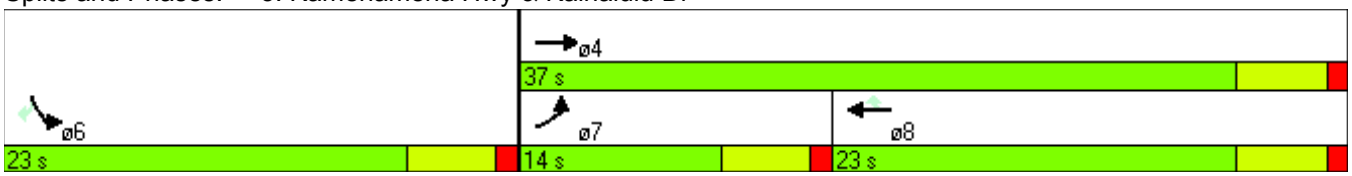
Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	141	350	360	55	51	128
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)	300			400	0	200
Storage Lanes	1			1	1	1
Taper Length (ft)	100				100	
Satd. Flow (prot)	1736	1681	1792	1509	1703	1509
Flt Permitted	0.950				0.950	
Satd. Flow (perm)	1736	1681	1792	1509	1703	1509
Right Turn on Red				Yes		Yes
Satd. Flow (RTOR)				127		139
Link Speed (mph)		45	45		30	
Link Distance (ft)		500	3000		500	
Travel Time (s)		7.6	45.5		11.4	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	4%	13%	6%	7%	6%	7%
Shared Lane Traffic (%)						
Lane Group Flow (vph)	153	380	391	60	55	139
Turn Type	Prot	NA	NA	Perm	NA	Perm
Protected Phases	7	4	8		6	
Permitted Phases				8		6
Detector Phase	7	4	8	8	6	6
Switch Phase						
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	10.0	22.0	22.0	22.0	22.0	22.0
Total Split (s)	14.0	37.0	23.0	23.0	23.0	23.0
Total Split (%)	23.3%	61.7%	38.3%	38.3%	38.3%	38.3%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead		Lag	Lag		
Lead-Lag Optimize?						
Recall Mode	None	None	None	None	Max	Max
Act Effct Green (s)	8.4	26.0	15.6	15.6	18.6	18.6
Actuated g/C Ratio	0.15	0.47	0.28	0.28	0.34	0.34
v/c Ratio	0.57	0.48	0.77	0.12	0.10	0.23
Control Delay	33.7	11.3	30.7	0.9	15.8	4.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	33.7	11.3	30.7	0.9	15.8	4.8
LOS	C	B	C	A	B	A
Approach Delay		17.7	26.7		7.9	
Approach LOS		B	C		A	
Queue Length 50th (ft)	52	75	125	0	14	0
Queue Length 95th (ft)	#117	130	#241	4	36	33
Internal Link Dist (ft)		420	2920		420	
Turn Bay Length (ft)	300			400		200
Base Capacity (vph)	294	1012	606	595	576	603
Starvation Cap Reductn	0	0	0	0	0	0

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.52	0.38	0.65	0.10	0.10	0.23

Intersection Summary

Area Type: Other
Cycle Length: 60
Actuated Cycle Length: 54.9
Natural Cycle: 60
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.77
Intersection Signal Delay: 19.6 Intersection LOS: B
Intersection Capacity Utilization 42.6% ICU Level of Service A
Analysis Period (min) 15
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 3: Kamehameha Hwy & Kaihalulu Dr

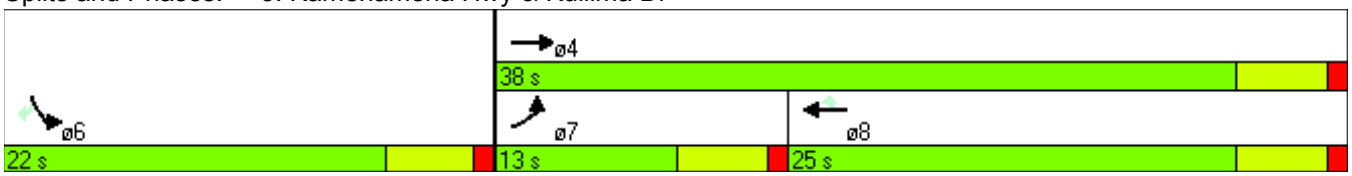


Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	83	318	331	111	135	84
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)	200			400	0	0
Storage Lanes	1			1	1	1
Taper Length (ft)	100				100	
Satd. Flow (prot)	1736	1681	1792	1509	1703	1509
Flt Permitted	0.950				0.950	
Satd. Flow (perm)	1734	1681	1792	1478	1680	1490
Right Turn on Red				Yes		Yes
Satd. Flow (RTOR)				127		127
Link Speed (mph)		45	45		25	
Link Distance (ft)		500	5500		500	
Travel Time (s)		7.6	83.3		13.6	
Confl. Peds. (#/hr)	1			1	7	
Confl. Bikes (#/hr)				12		1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	4%	13%	6%	7%	6%	7%
Shared Lane Traffic (%)						
Lane Group Flow (vph)	90	346	360	121	147	91
Turn Type	Prot	NA	NA	Perm	NA	Perm
Protected Phases	7	4	8		6	
Permitted Phases				8		6
Detector Phase	7	4	8	8	6	6
Switch Phase						
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	9.0	21.0	21.0	21.0	21.0	21.0
Total Split (s)	13.0	38.0	25.0	25.0	22.0	22.0
Total Split (%)	21.7%	63.3%	41.7%	41.7%	36.7%	36.7%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead		Lag	Lag		
Lead-Lag Optimize?						
Recall Mode	None	None	None	None	Min	Min
Act Effct Green (s)	7.7	20.5	14.2	14.2	9.8	9.8
Actuated g/C Ratio	0.19	0.49	0.34	0.34	0.24	0.24
v/c Ratio	0.28	0.42	0.59	0.21	0.37	0.20
Control Delay	22.0	7.8	17.6	4.0	19.5	3.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	22.0	7.8	17.6	4.0	19.5	3.5
LOS	C	A	B	A	B	A
Approach Delay		10.7	14.2		13.4	
Approach LOS		B	B		B	
Queue Length 50th (ft)	22	41	82	0	35	0
Queue Length 95th (ft)	65	97	169	26	84	18
Internal Link Dist (ft)		420	5420		420	
Turn Bay Length (ft)	200			400		

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Base Capacity (vph)	376	1320	971	859	784	755
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.24	0.26	0.37	0.14	0.19	0.12

Intersection Summary	
Area Type: Other	
Cycle Length: 60	
Actuated Cycle Length: 41.5	
Natural Cycle: 55	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 0.59	
Intersection Signal Delay: 12.7	Intersection LOS: B
Intersection Capacity Utilization 42.0%	ICU Level of Service A
Analysis Period (min) 15	

Splits and Phases: 5: Kamehameha Hwy & Kuilima Dr



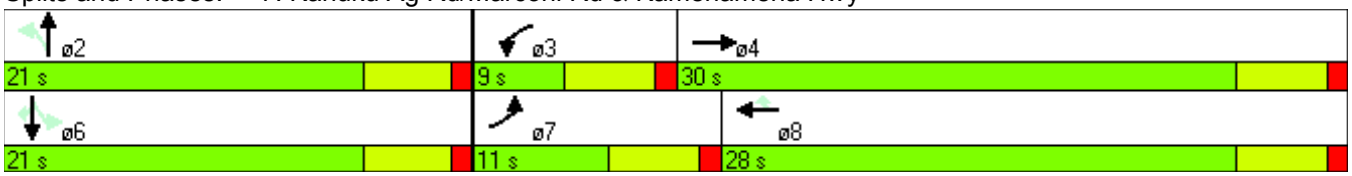
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	53	383	17	19	377	46	24	0	18	37	0	41
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	200		0	330		400	0		0	0		200
Storage Lanes	1		0	1		1	0		0	0		1
Taper Length (ft)	100			100			100			100		
Satd. Flow (prot)	1805	1649	0	1203	1792	1615	0	1160	0	0	1805	1615
Flt Permitted	0.950			0.950				0.803			0.727	
Satd. Flow (perm)	1805	1649	0	1203	1792	1567	0	957	0	0	1381	1615
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		4				127		127				127
Link Speed (mph)		45			45			30			25	
Link Distance (ft)		500			1200			500			500	
Travel Time (s)		7.6			18.2			11.4			13.6	
Confl. Bikes (#/hr)						10						
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	0%	13%	50%	50%	6%	0%	50%	2%	50%	0%	2%	0%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	58	434	0	21	410	50	0	46	0	0	40	45
Turn Type	Prot	NA		Prot	NA	Perm	Perm	NA		Perm	NA	Perm
Protected Phases	7	4		3	8			2			6	
Permitted Phases						8	2			6		6
Detector Phase	7	4		3	8	8	2	2		6	6	6
Switch Phase												
Minimum Initial (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Minimum Split (s)	9.0	21.0		9.0	21.0	21.0	21.0	21.0		21.0	21.0	21.0
Total Split (s)	11.0	30.0		9.0	28.0	28.0	21.0	21.0		21.0	21.0	21.0
Total Split (%)	18.3%	50.0%		15.0%	46.7%	46.7%	35.0%	35.0%		35.0%	35.0%	35.0%
Yellow Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
All-Red Time (s)	1.0	1.0		1.0	1.0	1.0	1.0	1.0		1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0		0.0	0.0	0.0		0.0			0.0	0.0
Total Lost Time (s)	5.0	5.0		5.0	5.0	5.0		5.0			5.0	5.0
Lead/Lag	Lead	Lag		Lead	Lag	Lag						
Lead-Lag Optimize?												
Recall Mode	None	None		None	None	None	Min	Min		Min	Min	Min
Act Effct Green (s)	6.4	16.5		4.4	14.5	14.5		7.2			7.2	7.2
Actuated g/C Ratio	0.18	0.46		0.12	0.40	0.40		0.20			0.20	0.20
v/c Ratio	0.18	0.57		0.14	0.57	0.07		0.16			0.14	0.11
Control Delay	19.3	10.7		22.8	12.9	0.2		1.1			17.7	0.5
Queue Delay	0.0	0.0		0.0	0.0	0.0		0.0			0.0	0.0
Total Delay	19.3	10.7		22.8	12.9	0.2		1.1			17.7	0.5
LOS	B	B		C	B	A		A			B	A
Approach Delay		11.7			12.0			1.1			8.6	
Approach LOS		B			B			A			A	
Queue Length 50th (ft)	8	43		3	40	0		0			5	0
Queue Length 95th (ft)	45	162		24	158	1		0			33	0
Internal Link Dist (ft)		420			1120			420			420	
Turn Bay Length (ft)	200			330		400						200
Base Capacity (vph)	331	1271		147	1262	1141		533			676	856

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Starvation Cap Reductn	0	0		0	0	0		0			0	0
Spillback Cap Reductn	0	0		0	0	0		0			0	0
Storage Cap Reductn	0	0		0	0	0		0			0	0
Reduced v/c Ratio	0.18	0.34		0.14	0.32	0.04		0.09			0.06	0.05

Intersection Summary

Area Type: Other
Cycle Length: 60
Actuated Cycle Length: 36
Natural Cycle: 55
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.57
Intersection Signal Delay: 11.2 Intersection LOS: B
Intersection Capacity Utilization 46.1% ICU Level of Service A
Analysis Period (min) 15

Splits and Phases: 7: Kahuku Ag Rd/Marconi Rd & Kamehameha Hwy



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	309	27	44	326	281	376
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0	0	0			450
Storage Lanes	1	1	1			1
Taper Length (ft)	100		100			
Satd. Flow (prot)	1719	1615	1805	1792	1845	1568
Flt Permitted	0.950		0.950			
Satd. Flow (perm)	1719	1615	1805	1792	1845	1568
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)		127				404
Link Speed (mph)	30			30	30	
Link Distance (ft)	220			382	754	
Travel Time (s)	5.0			8.7	17.1	
Peak Hour Factor	0.88	1.00	0.61	0.97	1.00	0.93
Heavy Vehicles (%)	5%	0%	0%	6%	3%	3%
Shared Lane Traffic (%)						
Lane Group Flow (vph)	351	27	72	336	281	404
Turn Type	NA	Perm	Prot	NA	NA	Perm
Protected Phases	3		1	6	2	
Permitted Phases		3				2
Detector Phase	3	3	1	6	2	2
Switch Phase						
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	21.0	21.0	9.0	9.0	21.0	21.0
Total Split (s)	26.0	26.0	11.0	34.0	23.0	23.0
Total Split (%)	43.3%	43.3%	18.3%	56.7%	38.3%	38.3%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag			Lead		Lag	Lag
Lead-Lag Optimize?						
Recall Mode	None	None	None	None	Max	Max
Act Effct Green (s)	15.1	15.1	6.1	25.5	19.7	19.7
Actuated g/C Ratio	0.30	0.30	0.12	0.50	0.39	0.39
v/c Ratio	0.69	0.05	0.33	0.37	0.39	0.47
Control Delay	24.1	0.1	28.5	10.1	16.7	4.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	24.1	0.1	28.5	10.1	16.7	4.3
LOS	C	A	C	B	B	A
Approach Delay	22.3			13.3	9.4	
Approach LOS	C			B	A	
Queue Length 50th (ft)	101	0	22	58	72	0
Queue Length 95th (ft)	170	0	39	125	147	54
Internal Link Dist (ft)	140			302	674	
Turn Bay Length (ft)						450
Base Capacity (vph)	732	760	219	1054	713	854
Starvation Cap Reductn	0	0	0	0	0	0

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.48	0.04	0.33	0.32	0.39	0.47

Intersection Summary

Area Type: Other
Cycle Length: 60
Actuated Cycle Length: 50.9
Natural Cycle: 55
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.69
Intersection Signal Delay: 13.8 Intersection LOS: B
Intersection Capacity Utilization 47.7% ICU Level of Service A
Analysis Period (min) 15

Splits and Phases: 3: J. P. Leong Hwy/Kamehameha Hwy

Intersection	
Intersection Delay (sec/veh):	$ 401.2

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Volume (vph)	42	97	373	152	503	450
Conflicting Peds.(#/hr)	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
Right Turn Channelized	Yield	Yield	Yield	Yield	None	None
Storage Length	0	0		200	0	
Median Width	12		0			0
Grade (%)	0%		0%			0%
Peak Hour Factor	0.75	0.84	0.97	0.83	0.77	1.00
Heavy Vehicles(%)	6	7	5	4	2	3
Movement Flow Rate	56	115	385	183	653	450
Number of Lanes	1	0	1	1	0	1

Major/Minor			Major 1			Major 2
Conflicting Flow Rate - All	2233	285	0	0	568	0
Stage 1	477	-	-	-	-	-
Stage 2	1756	-	-	-	-	-
Follow-up Headway	3.554	3.363	-	-	2.218	-
Pot Capacity-1 Maneuver	# 46	742	-	-	1004	-
Stage 1	616	-	-	-	-	-
Stage 2	149	-	-	-	-	-
Time blocked-Platoon(%)	0	0	-	-	0	-
Mov Capacity-1 Maneuver	# 6	742	-	-	1004	-
Mov Capacity-2 Maneuver	# 6	-	-	-	-	-
Stage 1	616	-	-	-	-	-
Stage 2	# 20	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay (s)	$ 4253.7	0	8.9
HCM LOS	F	A	A

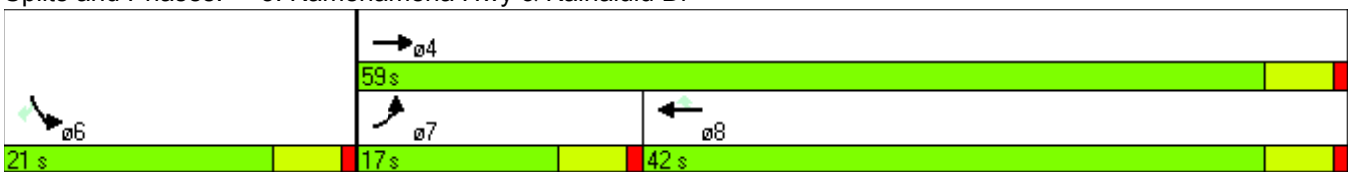
Lane	NBT	NBR	WBLn1	SBL	SBT
Capacity (vph)			18		
HCM Control Delay (s)	-	-	$ 4253.7	15.002	-
HCM Lane VC Ratio	-	-	9.526	0.651	-
HCM Lane LOS	-	-	F	C	-
HCM 95th Percentile Queue (veh)	-	-	22.095	5.014	-

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	102	466	499	17	19	99
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)	300			400	0	200
Storage Lanes	1			1	1	1
Taper Length (ft)	100				100	
Satd. Flow (prot)	1770	1845	1810	1495	1736	1509
Flt Permitted	0.950				0.950	
Satd. Flow (perm)	1770	1845	1810	1495	1736	1509
Right Turn on Red				Yes		Yes
Satd. Flow (RTOR)				95		108
Link Speed (mph)		45	45		30	
Link Distance (ft)		500	3000		500	
Travel Time (s)		7.6	45.5		11.4	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	2%	3%	5%	8%	4%	7%
Shared Lane Traffic (%)						
Lane Group Flow (vph)	111	507	542	18	21	108
Turn Type	Prot	NA	NA	Perm	NA	Perm
Protected Phases	7	4	8		6	
Permitted Phases				8		6
Detector Phase	7	4	8	8	6	6
Switch Phase						
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	10.0	22.0	22.0	22.0	22.0	22.0
Total Split (s)	17.0	59.0	42.0	42.0	21.0	21.0
Total Split (%)	21.3%	73.8%	52.5%	52.5%	26.3%	26.3%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead		Lag	Lag		
Lead-Lag Optimize?						
Recall Mode	None	None	None	None	Max	Max
Act Effct Green (s)	9.3	35.2	24.2	24.2	17.1	17.1
Actuated g/C Ratio	0.15	0.56	0.38	0.38	0.27	0.27
v/c Ratio	0.43	0.49	0.78	0.03	0.04	0.22
Control Delay	33.7	9.0	26.2	0.1	23.9	7.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	33.7	9.0	26.2	0.1	23.9	7.4
LOS	C	A	C	A	C	A
Approach Delay		13.4	25.3		10.1	
Approach LOS		B	C		B	
Queue Length 50th (ft)	41	97	185	0	6	0
Queue Length 95th (ft)	99	150	307	0	27	40
Internal Link Dist (ft)		420	2920		420	
Turn Bay Length (ft)	300			400		200
Base Capacity (vph)	360	1537	1136	973	471	488
Starvation Cap Reductn	0	0	0	0	0	0

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.31	0.33	0.48	0.02	0.04	0.22

Intersection Summary	
Area Type: Other	
Cycle Length: 80	
Actuated Cycle Length: 63	
Natural Cycle: 60	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 0.78	
Intersection Signal Delay: 18.2	Intersection LOS: B
Intersection Capacity Utilization 47.7%	ICU Level of Service A
Analysis Period (min) 15	

Splits and Phases: 3: Kamehameha Hwy & Kaihalulu Dr



Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	103	382	422	159	125	94
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)	200			400	0	0
Storage Lanes	1			1	1	1
Taper Length (ft)	100				100	
Satd. Flow (prot)	1741	1815	1781	1471	1715	1503
Flt Permitted	0.950				0.950	
Satd. Flow (perm)	1741	1815	1781	1443	1705	1482
Right Turn on Red				Yes		Yes
Satd. Flow (RTOR)				173		127
Link Speed (mph)		45	45		25	
Link Distance (ft)		500	5500		500	
Travel Time (s)		7.6	83.3		13.6	
Confl. Peds. (#/hr)					3	1
Confl. Bikes (#/hr)				12		1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	2%	3%	5%	8%	4%	7%
Bus Blockages (#/hr)	4	4	4	4	3	1
Shared Lane Traffic (%)						
Lane Group Flow (vph)	112	415	459	173	136	102
Turn Type	Prot	NA	NA	Perm	NA	Perm
Protected Phases	7	4	8		6	
Permitted Phases				8		6
Detector Phase	7	4	8	8	6	6
Switch Phase						
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	9.0	21.0	21.0	21.0	21.0	21.0
Total Split (s)	12.0	38.0	26.0	26.0	22.0	22.0
Total Split (%)	20.0%	63.3%	43.3%	43.3%	36.7%	36.7%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead		Lag	Lag		
Lead-Lag Optimize?						
Recall Mode	None	None	None	None	Min	Min
Act Effct Green (s)	7.2	25.2	16.6	16.6	9.4	9.4
Actuated g/C Ratio	0.16	0.55	0.36	0.36	0.21	0.21
v/c Ratio	0.41	0.41	0.71	0.27	0.38	0.25
Control Delay	26.7	7.0	20.9	3.8	21.6	4.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	26.7	7.0	20.9	3.8	21.6	4.8
LOS	C	A	C	A	C	A
Approach Delay		11.2	16.2		14.4	
Approach LOS		B	B		B	
Queue Length 50th (ft)	30	50	109	0	35	0
Queue Length 95th (ft)	#86	112	#219	31	79	23
Internal Link Dist (ft)		420	5420		420	

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Turn Bay Length (ft)	200			400		
Base Capacity (vph)	292	1313	897	812	699	679
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.38	0.32	0.51	0.21	0.19	0.15

Intersection Summary

Area Type: Other
Cycle Length: 60
Actuated Cycle Length: 45.6
Natural Cycle: 60
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.71
Intersection Signal Delay: 14.0 Intersection LOS: B
Intersection Capacity Utilization 47.6% ICU Level of Service A
Analysis Period (min) 15
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 5: Kamehameha Hwy & Kuilima Dr

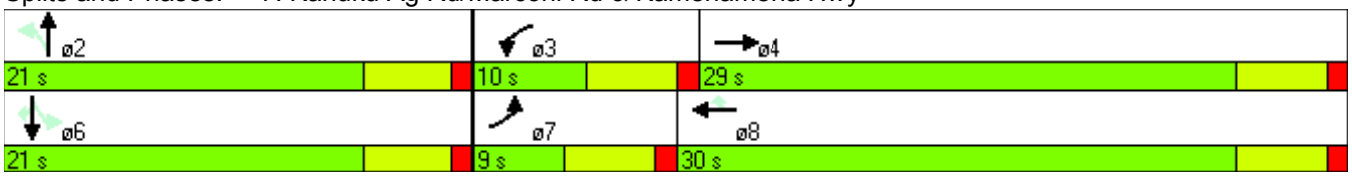
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	45	438	24	28	497	40	24	0	20	52	0	60
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	200		0	330		400	0		0	0		200
Storage Lanes	1		0	1		1	0		0	0		1
Taper Length (ft)	100			100			100			100		
Satd. Flow (prot)	1805	1788	0	1203	1810	1615	0	1157	0	0	1805	1615
Flt Permitted	0.950			0.950				0.806			0.726	
Satd. Flow (perm)	1805	1788	0	1203	1810	1568	0	958	0	0	1379	1615
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		5				127		127				127
Link Speed (mph)		45			45			30			25	
Link Distance (ft)		500			1200			493			500	
Travel Time (s)		7.6			18.2			11.2			13.6	
Confl. Bikes (#/hr)						10						
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	0%	3%	50%	50%	5%	0%	50%	2%	50%	0%	2%	0%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	49	502	0	30	540	43	0	48	0	0	57	65
Turn Type	Prot	NA		Prot	NA	Perm	Perm	NA		Perm	NA	Perm
Protected Phases	7	4		3	8			2			6	
Permitted Phases						8	2			6		6
Detector Phase	7	4		3	8	8	2	2		6	6	6
Switch Phase												
Minimum Initial (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Minimum Split (s)	9.0	21.0		9.0	21.0	21.0	21.0	21.0		21.0	21.0	21.0
Total Split (s)	9.0	29.0		10.0	30.0	30.0	21.0	21.0		21.0	21.0	21.0
Total Split (%)	15.0%	48.3%		16.7%	50.0%	50.0%	35.0%	35.0%		35.0%	35.0%	35.0%
Yellow Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
All-Red Time (s)	1.0	1.0		1.0	1.0	1.0	1.0	1.0		1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0		0.0	0.0	0.0		0.0			0.0	0.0
Total Lost Time (s)	5.0	5.0		5.0	5.0	5.0		5.0			5.0	5.0
Lead/Lag	Lead	Lag		Lead	Lag	Lag						
Lead-Lag Optimize?												
Recall Mode	None	None		None	None	None	Min	Min		Min	Min	Min
Act Effct Green (s)	4.4	16.9		5.5	17.2	17.2		7.8			7.8	7.8
Actuated g/C Ratio	0.11	0.44		0.14	0.45	0.45		0.20			0.20	0.20
v/c Ratio	0.24	0.64		0.18	0.67	0.06		0.16			0.21	0.15
Control Delay	24.2	13.8		23.4	14.2	0.1		1.2			18.8	1.9
Queue Delay	0.0	0.0		0.0	0.0	0.0		0.0			0.0	0.0
Total Delay	24.2	13.8		23.4	14.2	0.1		1.2			18.8	1.9
LOS	C	B		C	B	A		A			B	A
Approach Delay		14.7			13.6			1.2			9.8	
Approach LOS		B			B			A			A	
Queue Length 50th (ft)	9	54		5	61	0		0			9	0
Queue Length 95th (ft)	43	204		30	216	0		0			42	8
Internal Link Dist (ft)		420			1120			413			420	
Turn Bay Length (ft)	200			330		400						200
Base Capacity (vph)	206	1227		171	1289	1153		506			630	807

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Starvation Cap Reductn	0	0		0	0	0		0			0	0
Spillback Cap Reductn	0	0		0	0	0		0			0	0
Storage Cap Reductn	0	0		0	0	0		0			0	0
Reduced v/c Ratio	0.24	0.41		0.18	0.42	0.04		0.09			0.09	0.08

Intersection Summary

Area Type: Other
Cycle Length: 60
Actuated Cycle Length: 38.6
Natural Cycle: 60
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.67
Intersection Signal Delay: 13.3 Intersection LOS: B
Intersection Capacity Utilization 51.2% ICU Level of Service A
Analysis Period (min) 15

Splits and Phases: 7: Kahuku Ag Rd/Marconi Rd & Kamehameha Hwy



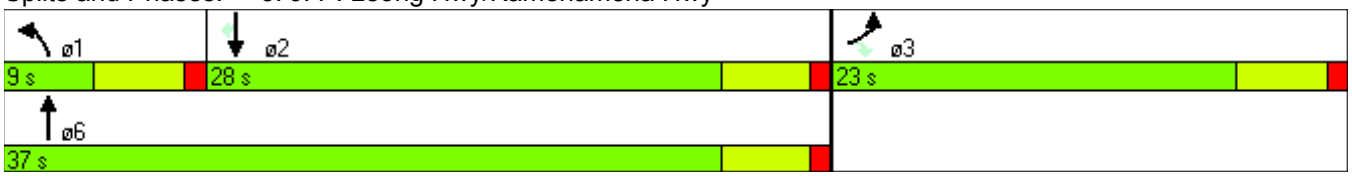
Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	382	18	43	560	422	458
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0	0	0			450
Storage Lanes	1	1	1			1
Taper Length (ft)	100		100			
Satd. Flow (prot)	1787	1615	1805	1900	1810	1583
Flt Permitted	0.950		0.950			
Satd. Flow (perm)	1787	1615	1805	1900	1810	1583
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)		127				472
Link Speed (mph)	30			30	30	
Link Distance (ft)	220			382	754	
Travel Time (s)	5.0			8.7	17.1	
Peak Hour Factor	0.97	1.00	1.00	0.99	0.85	0.97
Heavy Vehicles (%)	1%	0%	0%	0%	5%	2%
Shared Lane Traffic (%)						
Lane Group Flow (vph)	394	18	43	566	496	472
Turn Type	NA	Perm	Prot	NA	NA	Perm
Protected Phases	3		1	6	2	
Permitted Phases		3				2
Detector Phase	3	3	1	6	2	2
Switch Phase						
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	21.0	21.0	9.0	9.0	21.0	21.0
Total Split (s)	23.0	23.0	9.0	37.0	28.0	28.0
Total Split (%)	38.3%	38.3%	15.0%	61.7%	46.7%	46.7%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag			Lead		Lag	Lag
Lead-Lag Optimize?						
Recall Mode	None	None	None	None	Max	Max
Act Effct Green (s)	15.2	15.2	4.1	27.0	23.8	23.8
Actuated g/C Ratio	0.29	0.29	0.08	0.52	0.46	0.46
v/c Ratio	0.76	0.03	0.31	0.58	0.60	0.48
Control Delay	29.0	0.1	31.5	12.0	16.8	3.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	29.0	0.1	31.5	12.0	16.8	3.5
LOS	C	A	C	B	B	A
Approach Delay	27.7			13.4	10.3	
Approach LOS	C			B	B	
Queue Length 50th (ft)	95	0	12	113	96	0
Queue Length 95th (ft)	#244	0	42	203	225	50
Internal Link Dist (ft)	140			302	674	
Turn Bay Length (ft)						450
Base Capacity (vph)	624	647	140	1180	824	978
Starvation Cap Reductn	0	0	0	0	0	0

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.63	0.03	0.31	0.48	0.60	0.48

Intersection Summary

Area Type: Other
Cycle Length: 60
Actuated Cycle Length: 52.3
Natural Cycle: 60
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.76
Intersection Signal Delay: 14.9 Intersection LOS: B
Intersection Capacity Utilization 59.2% ICU Level of Service B
Analysis Period (min) 15
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 3: J. P. Leong Hwy/Kamehameha Hwy



Intersection	
Intersection Delay (sec/veh):	11.1

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Volume (vph)	61	290	768	77	91	693
Conflicting Peds.(#/hr)	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
Right Turn Channelized	Yield	Yield	Yield	Yield	None	None
Storage Length	0	0		200	0	
Median Width	12		0			0
Grade (%)	0%		0%			0%
Peak Hour Factor	0.95	0.98	0.96	0.84	1.00	1.00
Heavy Vehicles(%)	6	5	3	5	3	2
Movement Flow Rate	64	296	800	92	91	693
Number of Lanes	1	0	1	1	0	1

Major/Minor			Major 1			Major 2
Conflicting Flow Rate - All	1721	446	0	0	892	0
Stage 1	846	-	-	-	-	-
Stage 2	875	-	-	-	-	-
Follow-up Headway	3.554	3.345	-	-	2.227	-
Pot Capacity-1 Maneuver	96	606	-	-	756	-
Stage 1	414	-	-	-	-	-
Stage 2	401	-	-	-	-	-
Time blocked-Platoon(%)	0	0	-	-	0	-
Mov Capacity-1 Maneuver	77	606	-	-	756	-
Mov Capacity-2 Maneuver	77	-	-	-	-	-
Stage 1	414	-	-	-	-	-
Stage 2	322	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay (s)	60.2	0	1.2
HCM LOS	F	A	A

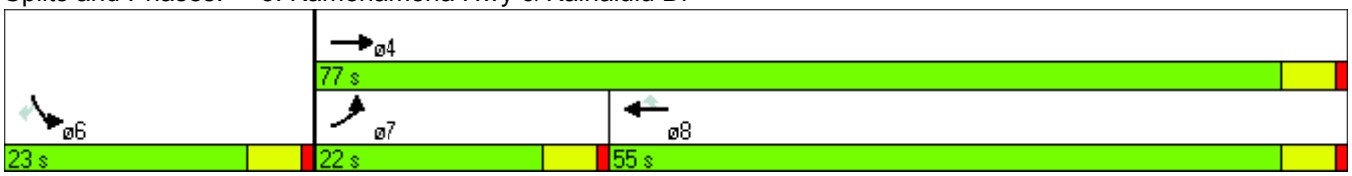
Lane	NBT	NBR	WBLn1	SBL	SBT
Capacity (vph)			392		
HCM Control Delay (s)	-	-	60.2	10.412	-
HCM Lane VC Ratio	-	-	0.919	0.12	-
HCM Lane LOS	-	-	F	B	-
HCM 95th Percentile Queue (veh)	-	-	9.799	0.409	-

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	171	598	630	37	62	192
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)	300			400	0	200
Storage Lanes	1			1	1	1
Taper Length (ft)	100				100	
Satd. Flow (prot)	1752	1863	1810	1553	1752	1583
Flt Permitted	0.950				0.950	
Satd. Flow (perm)	1752	1863	1810	1553	1752	1583
Right Turn on Red				Yes		Yes
Satd. Flow (RTOR)				76		209
Link Speed (mph)		45	45		30	
Link Distance (ft)		500	3000		500	
Travel Time (s)		7.6	45.5		11.4	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	3%	2%	5%	4%	3%	2%
Shared Lane Traffic (%)						
Lane Group Flow (vph)	186	650	685	40	67	209
Turn Type	Prot	NA	NA	Perm	NA	Perm
Protected Phases	7	4	8		6	
Permitted Phases				8		6
Detector Phase	7	4	8	8	6	6
Switch Phase						
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	10.0	22.0	22.0	22.0	22.0	22.0
Total Split (s)	22.0	77.0	55.0	55.0	23.0	23.0
Total Split (%)	22.0%	77.0%	55.0%	55.0%	23.0%	23.0%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead		Lag	Lag		
Lead-Lag Optimize?						
Recall Mode	None	None	None	None	Max	Max
Act Effct Green (s)	13.4	55.1	36.5	36.5	18.5	18.5
Actuated g/C Ratio	0.16	0.66	0.44	0.44	0.22	0.22
v/c Ratio	0.66	0.53	0.87	0.06	0.17	0.41
Control Delay	47.6	8.8	34.2	0.9	33.0	7.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	47.6	8.8	34.2	0.9	33.0	7.9
LOS	D	A	C	A	C	A
Approach Delay		17.5	32.3		14.0	
Approach LOS		B	C		B	
Queue Length 50th (ft)	93	153	316	0	29	0
Queue Length 95th (ft)	185	220	489	5	76	61
Internal Link Dist (ft)		420	2920		420	
Turn Bay Length (ft)	300			400		200
Base Capacity (vph)	365	1593	1109	981	386	512
Starvation Cap Reductn	0	0	0	0	0	0

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.51	0.41	0.62	0.04	0.17	0.41

Intersection Summary	
Area Type: Other	
Cycle Length: 100	
Actuated Cycle Length: 83.9	
Natural Cycle: 70	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 0.87	
Intersection Signal Delay: 22.8	Intersection LOS: C
Intersection Capacity Utilization 58.6%	ICU Level of Service B
Analysis Period (min) 15	

Splits and Phases: 3: Kamehameha Hwy & Kaihalulu Dr



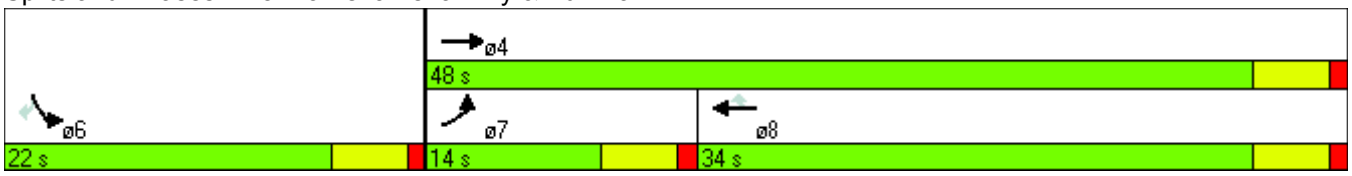
Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	125	535	533	175	177	134
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)	200			400	0	0
Storage Lanes	1			1	1	1
Taper Length (ft)	100				100	
Satd. Flow (prot)	1738	1848	1795	1540	1738	1571
Flt Permitted	0.950				0.950	
Satd. Flow (perm)	1738	1848	1795	1512	1738	1550
Right Turn on Red				Yes		Yes
Satd. Flow (RTOR)				190		146
Link Speed (mph)		45	45		25	
Link Distance (ft)		500	5500		500	
Travel Time (s)		7.6	83.3		13.6	
Confl. Bikes (#/hr)				12		1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	3%	2%	5%	4%	3%	2%
Bus Blockages (#/hr)	2	2	2	2	2	2
Shared Lane Traffic (%)						
Lane Group Flow (vph)	136	582	579	190	192	146
Turn Type	Prot	NA	NA	Perm	NA	Perm
Protected Phases	7	4	8		6	
Permitted Phases				8		6
Detector Phase	7	4	8	8	6	6
Switch Phase						
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	9.0	21.0	21.0	21.0	21.0	21.0
Total Split (s)	14.0	48.0	34.0	34.0	22.0	22.0
Total Split (%)	20.0%	68.6%	48.6%	48.6%	31.4%	31.4%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead		Lag	Lag		
Lead-Lag Optimize?						
Recall Mode	None	None	None	None	Min	Min
Act Effct Green (s)	8.9	32.8	22.9	22.9	12.1	12.1
Actuated g/C Ratio	0.16	0.58	0.41	0.41	0.22	0.22
v/c Ratio	0.50	0.54	0.79	0.26	0.51	0.33
Control Delay	34.4	8.8	25.6	3.4	27.8	6.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	34.4	8.8	25.6	3.4	27.8	6.9
LOS	C	A	C	A	C	A
Approach Delay		13.7	20.1		18.8	
Approach LOS		B	C		B	
Queue Length 50th (ft)	48	96	180	0	66	0
Queue Length 95th (ft)	#124	197	#372	34	128	40
Internal Link Dist (ft)		420	5420		420	
Turn Bay Length (ft)	200			400		

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Base Capacity (vph)	312	1387	1025	945	591	623
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.44	0.42	0.56	0.20	0.32	0.23

Intersection Summary	
Area Type: Other	
Cycle Length: 70	
Actuated Cycle Length: 56.1	
Natural Cycle: 60	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 0.79	
Intersection Signal Delay: 17.3	Intersection LOS: B
Intersection Capacity Utilization 57.3%	ICU Level of Service B
Analysis Period (min) 15	

\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 5: Kamehameha Hwy & Kuilima Dr



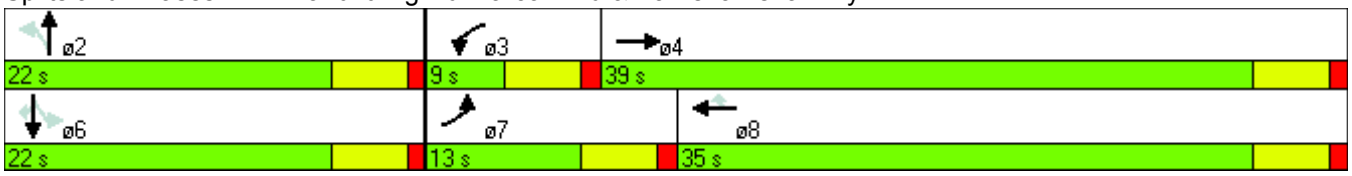
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	125	569	18	18	579	103	16	0	16	81	0	113
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	200		0	330		400	0		0	0		200
Storage Lanes	1		0	1		1	0		0	0		1
Taper Length (ft)	100			100			100			100		
Satd. Flow (prot)	1805	1812	0	1203	1812	1615	0	1152	0	0	1805	1615
Flt Permitted	0.950			0.950				0.828			0.735	
Satd. Flow (perm)	1805	1812	0	1203	1812	1569	0	977	0	0	1396	1615
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		3				112		109				123
Link Speed (mph)		45			45			30			25	
Link Distance (ft)		500			1200			500			500	
Travel Time (s)		7.6			18.2			11.4			13.6	
Confl. Bikes (#/hr)						10						
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	0%	2%	50%	50%	4%	0%	50%	2%	50%	0%	2%	0%
Bus Blockages (#/hr)	0	2	0	0	2	0	0	0	0	0	0	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	136	638	0	20	629	112	0	34	0	0	88	123
Turn Type	Prot	NA		Prot	NA	Perm	Perm	NA		Perm	NA	Perm
Protected Phases	7	4		3	8			2			6	
Permitted Phases						8	2			6		6
Detector Phase	7	4		3	8	8	2	2		6	6	6
Switch Phase												
Minimum Initial (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Minimum Split (s)	9.0	21.0		9.0	21.0	21.0	21.0	21.0		21.0	21.0	21.0
Total Split (s)	13.0	39.0		9.0	35.0	35.0	22.0	22.0		22.0	22.0	22.0
Total Split (%)	18.6%	55.7%		12.9%	50.0%	50.0%	31.4%	31.4%		31.4%	31.4%	31.4%
Yellow Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
All-Red Time (s)	1.0	1.0		1.0	1.0	1.0	1.0	1.0		1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0		0.0	0.0	0.0		0.0			0.0	0.0
Total Lost Time (s)	5.0	5.0		5.0	5.0	5.0		5.0			5.0	5.0
Lead/Lag	Lead	Lag		Lead	Lag	Lag						
Lead-Lag Optimize?												
Recall Mode	None	None		None	None	None	Min	Min		Min	Min	Min
Act Effct Green (s)	8.2	31.4		4.5	23.5	23.5		9.4			9.4	9.4
Actuated g/C Ratio	0.15	0.59		0.08	0.44	0.44		0.18			0.18	0.18
v/c Ratio	0.49	0.60		0.20	0.79	0.15		0.13			0.36	0.32
Control Delay	33.4	10.4		33.8	22.7	3.1		1.0			27.3	7.9
Queue Delay	0.0	0.0		0.0	0.0	0.0		0.0			0.0	0.0
Total Delay	33.4	10.4		33.8	22.7	3.1		1.0			27.3	7.9
LOS	C	B		C	C	A		A			C	A
Approach Delay		14.4			20.1			1.0			16.0	
Approach LOS		B			C			A			B	
Queue Length 50th (ft)	45	90		7	176	0		0			28	0
Queue Length 95th (ft)	#122	293		28	#347	24		0			68	38
Internal Link Dist (ft)		420			1120			420			420	
Turn Bay Length (ft)	200			330		400						200

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Base Capacity (vph)	301	1278		100	1096	993		417			495	652
Starvation Cap Reductn	0	0		0	0	0		0			0	0
Spillback Cap Reductn	0	0		0	0	0		0			0	0
Storage Cap Reductn	0	0		0	0	0		0			0	0
Reduced v/c Ratio	0.45	0.50		0.20	0.57	0.11		0.08			0.18	0.19

Intersection Summary

Area Type: Other
Cycle Length: 70
Actuated Cycle Length: 53.3
Natural Cycle: 60
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.79
Intersection Signal Delay: 16.8 Intersection LOS: B
Intersection Capacity Utilization 58.4% ICU Level of Service B
Analysis Period (min) 15
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 7: Kahuku Ag Rd/Marconi Rd & Kamehameha Hwy



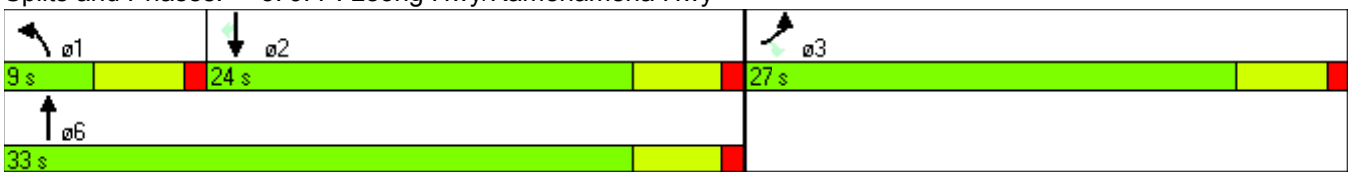
Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	440	41	76	567	459	523
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0	0	0			450
Storage Lanes	1	1	1			1
Taper Length (ft)	100		100			
Satd. Flow (prot)	1787	1615	1805	1845	1881	1583
Flt Permitted	0.950		0.950			
Satd. Flow (perm)	1787	1615	1805	1845	1881	1583
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)		127				588
Link Speed (mph)	30			30	30	
Link Distance (ft)	220			382	754	
Travel Time (s)	5.0			8.7	17.1	
Peak Hour Factor	0.84	0.68	1.00	1.00	0.97	0.89
Heavy Vehicles (%)	1%	0%	0%	3%	1%	2%
Shared Lane Traffic (%)						
Lane Group Flow (vph)	524	60	76	567	473	588
Turn Type	NA	Perm	Prot	NA	NA	Perm
Protected Phases	3		1	6	2	
Permitted Phases		3				2
Detector Phase	3	3	1	6	2	2
Switch Phase						
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	21.0	21.0	9.0	9.0	21.0	21.0
Total Split (s)	27.0	27.0	9.0	33.0	24.0	24.0
Total Split (%)	45.0%	45.0%	15.0%	55.0%	40.0%	40.0%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag			Lead		Lag	Lag
Lead-Lag Optimize?						
Recall Mode	None	None	None	None	Max	Max
Act Effct Green (s)	19.4	19.4	4.1	26.2	19.4	19.4
Actuated g/C Ratio	0.35	0.35	0.07	0.47	0.35	0.35
v/c Ratio	0.84	0.09	0.58	0.66	0.72	0.63
Control Delay	31.9	0.7	48.2	16.3	26.5	5.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	31.9	0.7	48.2	16.3	26.5	5.3
LOS	C	A	D	B	C	A
Approach Delay	28.7			20.1	14.7	
Approach LOS	C			C	B	
Queue Length 50th (ft)	165	0	28	148	154	0
Queue Length 95th (ft)	#278	0	#84	246	#294	59
Internal Link Dist (ft)	140			302	674	
Turn Bay Length (ft)						450
Base Capacity (vph)	718	725	132	944	653	933
Starvation Cap Reductn	0	0	0	0	0	0

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.73	0.08	0.58	0.60	0.72	0.63

Intersection Summary

Area Type: Other
Cycle Length: 60
Actuated Cycle Length: 55.8
Natural Cycle: 60
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.84
Intersection Signal Delay: 19.8 Intersection LOS: B
Intersection Capacity Utilization 65.2% ICU Level of Service C
Analysis Period (min) 15
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 3: J. P. Leong Hwy/Kamehameha Hwy



Intersection	
Intersection Delay (sec/veh):	19

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Volume (vph)	56	250	718	92	82	748
Conflicting Peds.(#/hr)	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
Right Turn Channelized	Yield	Yield	Yield	Yield	None	None
Storage Length	0	0		200	0	
Median Width	12		0			0
Grade (%)	0%		0%			0%
Peak Hour Factor	1.00	1.00	0.92	0.79	0.76	0.92
Heavy Vehicles(%)	7	2	2	6	4	3
Movement Flow Rate	56	250	780	116	108	813
Number of Lanes	1	0	1	1	0	1

Major/Minor			Major 1			Major 2
Conflicting Flow Rate - All	1867	448	0	0	896	0
Stage 1	838	-	-	-	-	-
Stage 2	1029	-	-	-	-	-
Follow-up Headway	3.563	3.318	-	-	2.236	-
Pot Capacity-1 Maneuver	77	611	-	-	749	-
Stage 1	416	-	-	-	-	-
Stage 2	337	-	-	-	-	-
Time blocked-Platoon(%)	0	0	-	-	0	-
Mov Capacity-1 Maneuver	57	611	-	-	749	-
Mov Capacity-2 Maneuver	57	-	-	-	-	-
Stage 1	416	-	-	-	-	-
Stage 2	248	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay (s)	128.3	0	1.2
HCM LOS	F	A	A

Lane	NBT	NBR	WBLn1	SBL	SBT
Capacity (vph)			275		
HCM Control Delay (s)	-	-	128.3	10.614	-
HCM Lane VC Ratio	-	-	1.113	0.144	-
HCM Lane LOS	-	-	F	B	-
HCM 95th Percentile Queue (veh)	-	-	12.823	0.502	-

HCS+: Two-Lane Highways Release 5.4

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Two-Way Two-Lane Highway Segment Analysis

Analyst	RSO
Agency/Co.	Traffic Management Consultant
Date Performed	11/3/11
Analysis Time Period	AM Peak Hour W/Resort Res Alt
Highway	Kamehameha Highway
From/To	West of Kaihalulu Drive
Jurisdiction	
Analysis Year	2025
Description	Turtle Bay Resort Master Plan

Input Data

Highway class	Class 1				
Shoulder width	6.0	ft	Peak-hour factor, PHF	0.92	
Lane width	12.0	ft	% Trucks and buses	8	%
Segment length	0.0	mi	% Recreational vehicles	0	%
Terrain type	Level		% No-passing zones	50	%
Grade: Length		mi	Access points/mi	2	/mi
Up/down		%			

Two-way hourly volume, V	979	veh/h		
Directional split	50 / 50	%		

Average Travel Speed

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.2	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor,	0.984	
Two-way flow rate,(note-1) vp	1081	pc/h
Highest directional split proportion (note-2)	541	pc/h

Free-Flow Speed from Field Measurement:		
Field measured speed, SFM	-	mi/h
Observed volume, Vf	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed, BFFS	45.0	mi/h
Adj. for lane and shoulder width, fLS	0.0	mi/h
Adj. for access points, fA	0.5	mi/h
Free-flow speed, FFS	44.5	mi/h

Adjustment for no-passing zones, fnp	1.6	mi/h
Average travel speed, ATS	34.5	mi/h

Percent Time-Spent-Following

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.1	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor, fHV	0.992	
Two-way flow rate,(note-1) vp	1073	pc/h
Highest directional split proportion (note-2)	537	
Base percent time-spent-following, BPTSF	61.1	%
Adj.for directional distribution and no-passing zones, fd/np	10.0	
Percent time-spent-following, PTSF	71.0	%

Level of Service and Other Performance Measures

Level of service, LOS	E	
Volume to capacity ratio, v/c	0.34	
Peak 15-min vehicle-miles of travel, VMT15	0	veh-mi
Peak-hour vehicle-miles of travel, VMT60	0	veh-mi
Peak 15-min total travel time, TT15	0.0	veh-h

Notes:
1. If vp >= 3200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split vp >= 1700 pc/h, terminate analysis-the LOS is F.

HCS+: Two-Lane Highways Release 5.4

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Two-Way Two-Lane Highway Segment Analysis

Analyst	RSO
Agency/Co.	Traffic Management Consultant
Date Performed	11/1/2011
Analysis Time Period	AM Peak Hour W/Resort Alt.
Highway	Kamehameha Highway
From/To	Haleiwa to Kawailoa
Jurisdiction	
Analysis Year	2025
Description	Turtle Bay Resort Master Plan

Input Data

Highway class	Class 1				
Shoulder width	6.0	ft	Peak-hour factor, PHF	0.95	
Lane width	12.0	ft	% Trucks and buses	5	%
Segment length	0.0	mi	% Recreational vehicles	0	%
Terrain type	Level		% No-passing zones	80	%
Grade: Length		mi	Access points/mi	2	/mi
Up/down		%			

Two-way hourly volume, V	1306	veh/h	
Directional split	51 / 49	%	

Average Travel Speed

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.1	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor,	0.995	
Two-way flow rate,(note-1) vp	1382	pc/h
Highest directional split proportion (note-2)	705	pc/h
Free-Flow Speed from Field Measurement:		
Field measured speed, SFM	-	mi/h
Observed volume, Vf	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed, BFFS	45.0	mi/h
Adj. for lane and shoulder width, fLS	0.0	mi/h
Adj. for access points, fA	0.5	mi/h
Free-flow speed, FFS	44.5	mi/h
Adjustment for no-passing zones, fnp	1.4	mi/h

Average travel speed, ATS 32.3 mi/h

Percent Time-Spent-Following

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.0	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor, fHV	1.000	
Two-way flow rate,(note-1) vp	1375	pc/h
Highest directional split proportion (note-2)	701	
Base percent time-spent-following, BPTSF	70.1	%
Adj.for directional distribution and no-passing zones, fd/np	7.6	
Percent time-spent-following, PTSF	77.8	%

Level of Service and Other Performance Measures

Level of service, LOS	E	
Volume to capacity ratio, v/c	0.43	
Peak 15-min vehicle-miles of travel, VMT15	0	veh-mi
Peak-hour vehicle-miles of travel, VMT60	0	veh-mi
Peak 15-min total travel time, TT15	0.0	veh-h

Notes:
1. If vp >= 3200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split vp >= 1700 pc/h, terminate analysis-the LOS is F.

HCS+: Two-Lane Highways Release 5.4

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Two-Way Two-Lane Highway Segment Analysis

Analyst	RSO
Agency/Co.	Traffic Management Consultant
Date Performed	11/1/2011
Analysis Time Period	AM Peak Hour W/Resort Res Alt
Highway	Kamehameha Highway
From/To	Hygienic Store
Jurisdiction	
Analysis Year	2025
Description	Turtle Bay Resort Master Plan

Input Data

Highway class	Class 1				
Shoulder width	6.0	ft	Peak-hour factor, PHF	0.89	
Lane width	12.0	ft	% Trucks and buses	3	%
Segment length	0.0	mi	% Recreational vehicles	0	%
Terrain type	Level		% No-passing zones	80	%
Grade: Length		mi	Access points/mi	10	/mi
Up/down		%			

Two-way hourly volume, V	1569	veh/h	
Directional split	65 / 35	%	

Average Travel Speed

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.1	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor,	0.997	
Two-way flow rate,(note-1) vp	1768	pc/h
Highest directional split proportion (note-2)	1149	pc/h
Free-Flow Speed from Field Measurement:		
Field measured speed, SFM	-	mi/h
Observed volume, Vf	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed, BFFS	45.0	mi/h
Adj. for lane and shoulder width, fLS	0.0	mi/h
Adj. for access points, fA	2.5	mi/h
Free-flow speed, FFS	42.5	mi/h
Adjustment for no-passing zones, fnp	1.1	mi/h

Average travel speed, ATS 27.6 mi/h

Percent Time-Spent-Following

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.0	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor, fHV	1.000	
Two-way flow rate,(note-1) vp	1763	pc/h
Highest directional split proportion (note-2)	1146	
Base percent time-spent-following, BPTSF	78.8	%
Adj.for directional distribution and no-passing zones, fd/np	5.5	
Percent time-spent-following, PTSF	84.2	%

Level of Service and Other Performance Measures

Level of service, LOS	E	
Volume to capacity ratio, v/c	0.55	
Peak 15-min vehicle-miles of travel, VMT15	0	veh-mi
Peak-hour vehicle-miles of travel, VMT60	0	veh-mi
Peak 15-min total travel time, TT15	0.0	veh-h

Notes:
1. If vp >= 3200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split vp >= 1700 pc/h, terminate analysis-the LOS is F.

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Two-Way Two-Lane Highway Segment Analysis

Analyst	RSO
Agency/Co.	Traffic Management Consultant
Date Performed	11/3/11
Analysis Time Period	PM Peak Hour W/Resort Res Alt
Highway	Kamehameha Highway
From/To	West of Kaihalulu Drive
Jurisdiction	
Analysis Year	2025
Description	Turtle Bay Resort Master Plan

Input Data

Highway class	Class 1				
Shoulder width	6.0	ft	Peak-hour factor, PHF	0.92	
Lane width	12.0	ft	% Trucks and buses	4	%
Segment length	0.0	mi	% Recreational vehicles	0	%
Terrain type	Level		% No-passing zones	50	%
Grade: Length		mi	Access points/mi	2	/mi
Up/down		%			

Two-way hourly volume, V	1166	veh/h	
Directional split	51 / 49	%	

Average Travel Speed

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.1	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor,	0.996	
Two-way flow rate,(note-1) vp	1272	pc/h
Highest directional split proportion (note-2)	649	pc/h
Free-Flow Speed from Field Measurement:		
Field measured speed, SFM	-	mi/h
Observed volume, Vf	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed, BFFS	45.0	mi/h
Adj. for lane and shoulder width, fLS	0.0	mi/h
Adj. for access points, fA	0.5	mi/h
Free-flow speed, FFS	44.5	mi/h
Adjustment for no-passing zones, fnp	1.3	mi/h

Average travel speed, ATS 33.4 mi/h

Percent Time-Spent-Following

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.0	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor, fHV	1.000	
Two-way flow rate,(note-1) vp	1267	pc/h
Highest directional split proportion (note-2)	646	
Base percent time-spent-following, BPTSF	67.2	%
Adj.for directional distribution and no-passing zones, fd/np	7.7	
Percent time-spent-following, PTSF	74.8	%

Level of Service and Other Performance Measures

Level of service, LOS	E	
Volume to capacity ratio, v/c	0.40	
Peak 15-min vehicle-miles of travel, VMT15	0	veh-mi
Peak-hour vehicle-miles of travel, VMT60	0	veh-mi
Peak 15-min total travel time, TT15	0.0	veh-h

Notes:
1. If vp >= 3200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split vp >= 1700 pc/h, terminate analysis-the LOS is F.

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Two-Way Two-Lane Highway Segment Analysis

Analyst	RSO
Agency/Co.	Traffic Management Consultant
Date Performed	11/1/2011
Analysis Time Period	PM Peak Hour W/Resort Alt
Highway	Kamehameha Highway
From/To	Haleiwa to Kawailoa
Jurisdiction	
Analysis Year	2025
Description	Turtle Bay Resort Master Plan

Input Data

Highway class	Class 1				
Shoulder width	6.0	ft	Peak-hour factor, PHF	0.94	
Lane width	12.0	ft	% Trucks and buses	2	%
Segment length	0.0	mi	% Recreational vehicles	0	%
Terrain type	Level		% No-passing zones	80	%
Grade: Length		mi	Access points/mi	2	/mi
Up/down		%			

Two-way hourly volume, V	1722	veh/h	
Directional split	51 / 49	%	

Average Travel Speed

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.1	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor,	0.998	
Two-way flow rate,(note-1) vp	1836	pc/h
Highest directional split proportion (note-2)	936	pc/h
Free-Flow Speed from Field Measurement:		
Field measured speed, SFM	-	mi/h
Observed volume, Vf	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed, BFFS	45.0	mi/h
Adj. for lane and shoulder width, fLS	0.0	mi/h
Adj. for access points, fA	0.5	mi/h
Free-flow speed, FFS	44.5	mi/h
Adjustment for no-passing zones, fnp	1.1	mi/h

Average travel speed, ATS 29.2 mi/h

Percent Time-Spent-Following

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.0	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor, fHV	1.000	
Two-way flow rate,(note-1) vp	1832	pc/h
Highest directional split proportion (note-2)	934	
Base percent time-spent-following, BPTSF	80.0	%
Adj.for directional distribution and no-passing zones, fd/np	5.0	
Percent time-spent-following, PTSF	85.0	%

Level of Service and Other Performance Measures

Level of service, LOS	E	
Volume to capacity ratio, v/c	0.57	
Peak 15-min vehicle-miles of travel, VMT15	0	veh-mi
Peak-hour vehicle-miles of travel, VMT60	0	veh-mi
Peak 15-min total travel time, TT15	0.0	veh-h

Notes:
1. If vp >= 3200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split vp >= 1700 pc/h, terminate analysis-the LOS is F.

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Two-Way Two-Lane Highway Segment Analysis

Analyst	RSO
Agency/Co.	Traffic Management Consultant
Date Performed	11/1/2011
Analysis Time Period	PM Peak Hour W/Resort Res Alt
Highway	Kamehameha Highway
From/To	Hygienic Store
Jurisdiction	
Analysis Year	2025
Description	Turtle Bay Resort Master Plan

Input Data

Highway class	Class 1				
Shoulder width	6.0	ft	Peak-hour factor, PHF	0.99	
Lane width	12.0	ft	% Trucks and buses	5	%
Segment length	0.0	mi	% Recreational vehicles	0	%
Terrain type	Level		% No-passing zones	80	%
Grade: Length		mi	Access points/mi	10	/mi
Up/down		%			

Two-way hourly volume, V	2005	veh/h		
Directional split	57	/	43	%

Average Travel Speed

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.1	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor,	0.995	
Two-way flow rate,(note-1) vp	2035	pc/h
Highest directional split proportion (note-2)	1160	pc/h
Free-Flow Speed from Field Measurement:		
Field measured speed, SFM	-	mi/h
Observed volume, Vf	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed, BFFS	45.0	mi/h
Adj. for lane and shoulder width, fLS	0.0	mi/h
Adj. for access points, fA	2.5	mi/h
Free-flow speed, FFS	42.5	mi/h
Adjustment for no-passing zones, fnp	1.0	mi/h

Average travel speed, ATS 25.7 mi/h

Percent Time-Spent-Following

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.0	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor, fHV	1.000	
Two-way flow rate,(note-1) vp	2025	pc/h
Highest directional split proportion (note-2)	1154	
Base percent time-spent-following, BPTSF	83.1	%
Adj.for directional distribution and no-passing zones, fd/np	4.0	
Percent time-spent-following, PTSF	87.1	%

Level of Service and Other Performance Measures

Level of service, LOS	E	
Volume to capacity ratio, v/c	0.64	
Peak 15-min vehicle-miles of travel, VMT15	0	veh-mi
Peak-hour vehicle-miles of travel, VMT60	0	veh-mi
Peak 15-min total travel time, TT15	0.0	veh-h

Notes:
1. If vp >= 3200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split vp >= 1700 pc/h, terminate analysis-the LOS is F.

HCS+: Two-Lane Highways Release 5.4

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Two-Way Two-Lane Highway Segment Analysis

Analyst	RSO
Agency/Co.	Traffic Management Consultant
Date Performed	11/5/11
Analysis Time Period	Sat Peak Hr W/Resort Res Alt
Highway	Kamehameha Highway
From/To	West of Kaihalulu Drive
Jurisdiction	
Analysis Year	2025
Description	Turtle Bay Resort Master Plan

Input Data

Highway class	Class 1				
Shoulder width	6.0	ft	Peak-hour factor, PHF	0.92	
Lane width	12.0	ft	% Trucks and buses	3	%
Segment length	0.0	mi	% Recreational vehicles	0	%
Terrain type	Level		% No-passing zones	50	%
Grade: Length		mi	Access points/mi	2	/mi
Up/down		%			

Two-way hourly volume, V	822	veh/h		
Directional split	52 / 48	%		

Average Travel Speed

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.2	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor,	0.994	
Two-way flow rate,(note-1) vp	899	pc/h
Highest directional split proportion (note-2)	467	pc/h
Free-Flow Speed from Field Measurement:		
Field measured speed, SFM	-	mi/h
Observed volume, Vf	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed, BFFS	45.0	mi/h
Adj. for lane and shoulder width, fLS	0.0	mi/h
Adj. for access points, fA	0.5	mi/h
Free-flow speed, FFS	44.5	mi/h
Adjustment for no-passing zones, fnp	2.0	mi/h

Average travel speed, ATS 35.5 mi/h

Percent Time-Spent-Following

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.1	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor, fHV	0.997	
Two-way flow rate,(note-1) vp	896	pc/h
Highest directional split proportion (note-2)	466	
Base percent time-spent-following, BPTSF	54.5	%
Adj.for directional distribution and no-passing zones, fd/np	11.8	
Percent time-spent-following, PTSF	66.3	%

Level of Service and Other Performance Measures

Level of service, LOS	E	
Volume to capacity ratio, v/c	0.28	
Peak 15-min vehicle-miles of travel, VMT15	0	veh-mi
Peak-hour vehicle-miles of travel, VMT60	0	veh-mi
Peak 15-min total travel time, TT15	0.0	veh-h

Notes:
1. If vp >= 3200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split vp >= 1700 pc/h, terminate analysis-the LOS is F.

HCS+: Two-Lane Highways Release 5.4

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Two-Way Two-Lane Highway Segment Analysis

Analyst	RSO
Agency/Co.	Traffic Management Consultant
Date Performed	10/29/2011
Analysis Time Period	Sat. Peak Hr W/Resort Alt
Highway	Kamehameha Highway
From/To	Haleiwa to Kawailoa
Jurisdiction	
Analysis Year	2025
Description	Turtle Bay Resort Master Plan

Input Data

Highway class	Class 1				
Shoulder width	6.0	ft	Peak-hour factor, PHF	0.93	
Lane width	12.0	ft	% Trucks and buses	2	%
Segment length	0.0	mi	% Recreational vehicles	0	%
Terrain type	Level		% No-passing zones	80	%
Grade: Length		mi	Access points/mi	2	/mi
Up/down		%			

Two-way hourly volume, V	1990	veh/h		
Directional split	50	/	50	%

Average Travel Speed

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.1	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor,	0.998	
Two-way flow rate,(note-1) vp	2144	pc/h
Highest directional split proportion (note-2)	1072	pc/h
Free-Flow Speed from Field Measurement:		
Field measured speed, SFM	-	mi/h
Observed volume, Vf	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed, BFFS	45.0	mi/h
Adj. for lane and shoulder width, fLS	0.0	mi/h
Adj. for access points, fA	0.5	mi/h
Free-flow speed, FFS	44.5	mi/h
Adjustment for no-passing zones, fnp	0.9	mi/h

Average travel speed, ATS 26.9 mi/h

Percent Time-Spent-Following

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.0	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor, fHV	1.000	
Two-way flow rate,(note-1) vp	2140	pc/h
Highest directional split proportion (note-2)	1070	
Base percent time-spent-following, BPTSF	84.8	%
Adj.for directional distribution and no-passing zones, fd/np	3.7	
Percent time-spent-following, PTSF	88.4	%

Level of Service and Other Performance Measures

Level of service, LOS	E	
Volume to capacity ratio, v/c	0.67	
Peak 15-min vehicle-miles of travel, VMT15	0	veh-mi
Peak-hour vehicle-miles of travel, VMT60	0	veh-mi
Peak 15-min total travel time, TT15	0.0	veh-h

Notes:
1. If vp >= 3200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split vp >= 1700 pc/h, terminate analysis-the LOS is F.

HCS+: Two-Lane Highways Release 5.4

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Two-Way Two-Lane Highway Segment Analysis

Analyst	RSO
Agency/Co.	Traffic Management Consultant
Date Performed	10/29/2011
Analysis Time Period	Sat Peak Hr W/Resort Res Alt
Highway	Kamehameha Highway
From/To	Hygienic Store
Jurisdiction	
Analysis Year	2025
Description	Turtle Bay Resort Master Plan

Input Data

Highway class	Class 1				
Shoulder width	6.0	ft	Peak-hour factor, PHF	0.94	
Lane width	12.0	ft	% Trucks and buses	3	%
Segment length	0.0	mi	% Recreational vehicles	0	%
Terrain type	Level		% No-passing zones	80	%
Grade: Length		mi	Access points/mi	10	/mi
Up/down		%			

Two-way hourly volume, V	2056	veh/h	
Directional split	54 / 46	%	

Average Travel Speed

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.1	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor,	0.997	
Two-way flow rate,(note-1) vp	2194	pc/h
Highest directional split proportion (note-2)	1185	pc/h
Free-Flow Speed from Field Measurement:		
Field measured speed, SFM	-	mi/h
Observed volume, Vf	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed, BFFS	45.0	mi/h
Adj. for lane and shoulder width, fLS	0.0	mi/h
Adj. for access points, fA	2.5	mi/h
Free-flow speed, FFS	42.5	mi/h
Adjustment for no-passing zones, fnp	0.9	mi/h

Average travel speed, ATS 24.6 mi/h

Percent Time-Spent-Following

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.0	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor, fHV	1.000	
Two-way flow rate,(note-1) vp	2187	pc/h
Highest directional split proportion (note-2)	1181	
Base percent time-spent-following, BPTSF	85.4	%
Adj.for directional distribution and no-passing zones, fd/np	3.5	
Percent time-spent-following, PTSF	88.9	%

Level of Service and Other Performance Measures

Level of service, LOS	E	
Volume to capacity ratio, v/c	0.69	
Peak 15-min vehicle-miles of travel, VMT15	0	veh-mi
Peak-hour vehicle-miles of travel, VMT60	0	veh-mi
Peak 15-min total travel time, TT15	0.0	veh-h

Notes:
1. If vp >= 3200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split vp >= 1700 pc/h, terminate analysis-the LOS is F.

TRAFFIC IMPACT ANALYSIS REPORT

FOR THE PROPOSED

TURTLE BAY RESORT MASTER PLAN

KAHUKU, OAHU, HAWAII

APPENDIX F

CAPACITY ANALYSIS WORKSHEETS

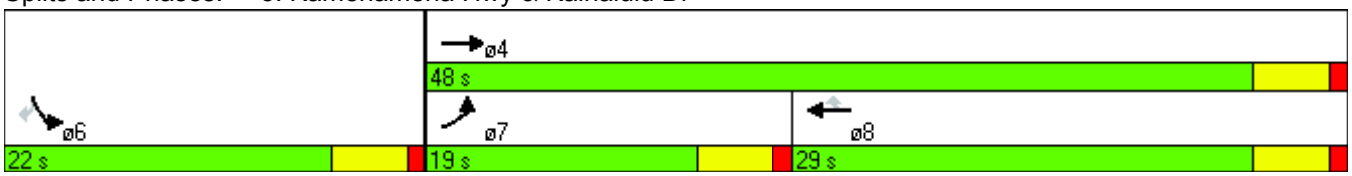
2025 TRAFFIC CONDITIONS WITH CONSERVATION PARTNER ALTERNATIVE

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	182	362	371	68	73	173
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)	300			400	0	200
Storage Lanes	1			1	1	1
Taper Length (ft)	100				100	
Satd. Flow (prot)	1736	1681	1792	1509	1703	1509
Flt Permitted	0.950				0.950	
Satd. Flow (perm)	1736	1681	1792	1509	1703	1509
Right Turn on Red				Yes		Yes
Satd. Flow (RTOR)				109		188
Link Speed (mph)		45	45		30	
Link Distance (ft)		500	3000		500	
Travel Time (s)		7.6	45.5		11.4	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	4%	13%	6%	7%	6%	7%
Shared Lane Traffic (%)						
Lane Group Flow (vph)	198	393	403	74	79	188
Turn Type	Prot	NA	NA	Perm	NA	Perm
Protected Phases	7	4	8		6	
Permitted Phases				8		6
Detector Phase	7	4	8	8	6	6
Switch Phase						
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	10.0	22.0	22.0	22.0	22.0	22.0
Total Split (s)	19.0	48.0	29.0	29.0	22.0	22.0
Total Split (%)	27.1%	68.6%	41.4%	41.4%	31.4%	31.4%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead		Lag	Lag		
Lead-Lag Optimize?						
Recall Mode	None	None	None	None	Max	Max
Act Effct Green (s)	11.4	35.0	18.5	18.5	17.3	17.3
Actuated g/C Ratio	0.18	0.56	0.30	0.30	0.28	0.28
v/c Ratio	0.62	0.42	0.76	0.14	0.17	0.34
Control Delay	33.9	9.0	30.2	2.4	21.1	5.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	33.9	9.0	30.2	2.4	21.1	5.9
LOS	C	A	C	A	C	A
Approach Delay		17.3	25.9		10.4	
Approach LOS		B	C		B	
Queue Length 50th (ft)	70	75	139	0	23	0
Queue Length 95th (ft)	140	124	236	14	60	45
Internal Link Dist (ft)		420	2920		420	
Turn Bay Length (ft)	300			400		200
Base Capacity (vph)	395	1175	699	655	471	553
Starvation Cap Reductn	0	0	0	0	0	0

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.50	0.33	0.58	0.11	0.17	0.34

Intersection Summary	
Area Type: Other	
Cycle Length: 70	
Actuated Cycle Length: 62.4	
Natural Cycle: 60	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 0.76	
Intersection Signal Delay: 19.0	Intersection LOS: B
Intersection Capacity Utilization 46.2%	ICU Level of Service A
Analysis Period (min) 15	

Splits and Phases: 3: Kamehameha Hwy & Kaihalulu Dr

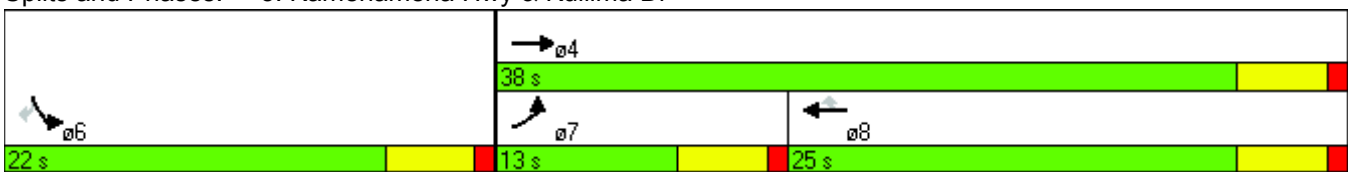


Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	100	335	339	128	156	100
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)	200			400	0	0
Storage Lanes	1			1	1	1
Taper Length (ft)	100				100	
Satd. Flow (prot)	1736	1681	1792	1509	1703	1509
Flt Permitted	0.950				0.950	
Satd. Flow (perm)	1734	1681	1792	1478	1680	1490
Right Turn on Red				Yes		Yes
Satd. Flow (RTOR)				139		127
Link Speed (mph)		45	45		25	
Link Distance (ft)		500	5500		500	
Travel Time (s)		7.6	83.3		13.6	
Confl. Peds. (#/hr)	1			1	7	
Confl. Bikes (#/hr)				12		1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	4%	13%	6%	7%	6%	7%
Shared Lane Traffic (%)						
Lane Group Flow (vph)	109	364	368	139	170	109
Turn Type	Prot	NA	NA	Perm	NA	Perm
Protected Phases	7	4	8		6	
Permitted Phases				8		6
Detector Phase	7	4	8	8	6	6
Switch Phase						
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	9.0	21.0	21.0	21.0	21.0	21.0
Total Split (s)	13.0	38.0	25.0	25.0	22.0	22.0
Total Split (%)	21.7%	63.3%	41.7%	41.7%	36.7%	36.7%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead		Lag	Lag		
Lead-Lag Optimize?						
Recall Mode	None	None	None	None	Min	Min
Act Effct Green (s)	7.7	23.7	14.4	14.4	10.4	10.4
Actuated g/C Ratio	0.17	0.53	0.32	0.32	0.23	0.23
v/c Ratio	0.37	0.41	0.64	0.25	0.43	0.25
Control Delay	24.7	7.8	20.5	4.4	21.1	4.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	24.7	7.8	20.5	4.4	21.1	4.9
LOS	C	A	C	A	C	A
Approach Delay		11.7	16.1		14.8	
Approach LOS		B	B		B	
Queue Length 50th (ft)	27	46	87	0	42	0
Queue Length 95th (ft)	77	109	179	30	95	25
Internal Link Dist (ft)		420	5420		420	
Turn Bay Length (ft)	200			400		

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Base Capacity (vph)	340	1229	879	795	710	695
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.32	0.30	0.42	0.17	0.24	0.16

Intersection Summary	
Area Type: Other	
Cycle Length: 60	
Actuated Cycle Length: 45.1	
Natural Cycle: 55	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 0.64	
Intersection Signal Delay: 14.1	Intersection LOS: B
Intersection Capacity Utilization 44.5%	ICU Level of Service A
Analysis Period (min) 15	

Splits and Phases: 5: Kamehameha Hwy & Kuilima Dr

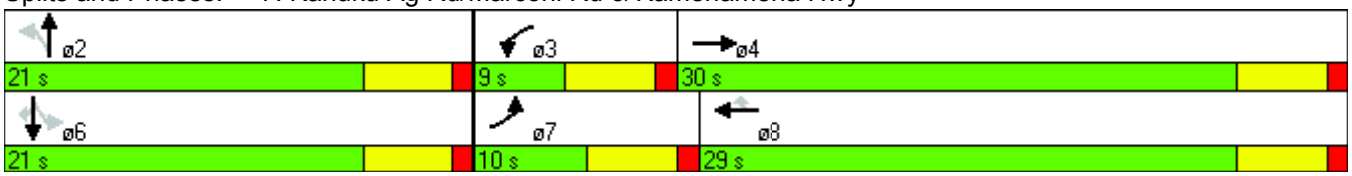


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	48	426	17	19	407	41	24	0	18	33	0	36
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	200		0	330		400	0		0	0		200
Storage Lanes	1		0	1		1	0		0	0		1
Taper Length (ft)	100			100			100			100		
Satd. Flow (prot)	1805	1805	0	1203	1812	1615	0	1160	0	0	1805	1615
Flt Permitted	0.950			0.950				0.805			0.727	
Satd. Flow (perm)	1805	1805	0	1203	1812	1568	0	960	0	0	1381	1615
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		4				127		127				127
Link Speed (mph)		45			45			30			25	
Link Distance (ft)		500			1200			500			500	
Travel Time (s)		7.6			18.2			11.4			13.6	
Confl. Bikes (#/hr)						10						
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	0%	2%	50%	50%	4%	0%	50%	2%	50%	0%	2%	0%
Bus Blockages (#/hr)	0	2	0	0	2	0	0	0	0	0	0	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	52	481	0	21	442	45	0	46	0	0	36	39
Turn Type	Prot	NA		Prot	NA	Perm	Perm	NA		Perm	NA	Perm
Protected Phases	7	4		3	8			2			6	
Permitted Phases						8	2			6		6
Detector Phase	7	4		3	8	8	2	2		6	6	6
Switch Phase												
Minimum Initial (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Minimum Split (s)	9.0	21.0		9.0	21.0	21.0	21.0	21.0		21.0	21.0	21.0
Total Split (s)	10.0	30.0		9.0	29.0	29.0	21.0	21.0		21.0	21.0	21.0
Total Split (%)	16.7%	50.0%		15.0%	48.3%	48.3%	35.0%	35.0%		35.0%	35.0%	35.0%
Yellow Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
All-Red Time (s)	1.0	1.0		1.0	1.0	1.0	1.0	1.0		1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0		0.0	0.0	0.0		0.0			0.0	0.0
Total Lost Time (s)	5.0	5.0		5.0	5.0	5.0		5.0			5.0	5.0
Lead/Lag	Lead	Lag		Lead	Lag	Lag						
Lead-Lag Optimize?												
Recall Mode	None	None		None	None	None	Min	Min		Min	Min	Min
Act Effct Green (s)	5.5	16.6		4.4	14.9	14.9		7.1			7.1	7.1
Actuated g/C Ratio	0.15	0.46		0.12	0.42	0.42		0.20			0.20	0.20
v/c Ratio	0.19	0.57		0.14	0.59	0.06		0.16			0.13	0.09
Control Delay	20.4	10.3		22.7	12.6	0.2		1.2			17.7	0.4
Queue Delay	0.0	0.0		0.0	0.0	0.0		0.0			0.0	0.0
Total Delay	20.4	10.3		22.7	12.6	0.2		1.2			17.7	0.4
LOS	C	B		C	B	A		A			B	A
Approach Delay		11.3			12.0			1.2			8.7	
Approach LOS		B			B			A			A	
Queue Length 50th (ft)	8	48		3	43	0		0			5	0
Queue Length 95th (ft)	42	173		24	163	0		0			30	0
Internal Link Dist (ft)		420			1120			420			420	
Turn Bay Length (ft)	200			330		400						200

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Base Capacity (vph)	275	1386		146	1328	1183		533			674	854
Starvation Cap Reductn	0	0		0	0	0		0			0	0
Spillback Cap Reductn	0	0		0	0	0		0			0	0
Storage Cap Reductn	0	0		0	0	0		0			0	0
Reduced v/c Ratio	0.19	0.35		0.14	0.33	0.04		0.09			0.05	0.05

Intersection Summary	
Area Type: Other	
Cycle Length: 60	
Actuated Cycle Length: 35.9	
Natural Cycle: 55	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 0.59	
Intersection Signal Delay: 11.0	Intersection LOS: B
Intersection Capacity Utilization 48.4%	ICU Level of Service A
Analysis Period (min) 15	

Splits and Phases: 7: Kahuku Ag Rd/Marconi Rd & Kamehameha Hwy

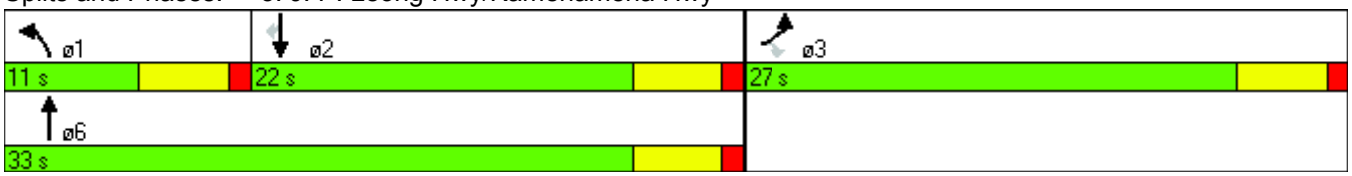


Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	330	27	44	347	300	401
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0	0	0			450
Storage Lanes	1	1	1			1
Taper Length (ft)	100		100			
Satd. Flow (prot)	1719	1615	1805	1792	1845	1568
Flt Permitted	0.950		0.950			
Satd. Flow (perm)	1719	1615	1805	1792	1845	1568
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)		127				427
Link Speed (mph)	30			30	30	
Link Distance (ft)	220			382	754	
Travel Time (s)	5.0			8.7	17.1	
Peak Hour Factor	0.88	1.00	0.61	0.96	1.00	0.94
Heavy Vehicles (%)	5%	0%	0%	6%	3%	3%
Shared Lane Traffic (%)						
Lane Group Flow (vph)	375	27	72	361	300	427
Turn Type	NA	Perm	Prot	NA	NA	Perm
Protected Phases	3		1	6	2	
Permitted Phases		3				2
Detector Phase	3	3	1	6	2	2
Switch Phase						
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	21.0	21.0	9.0	9.0	21.0	21.0
Total Split (s)	27.0	27.0	11.0	33.0	22.0	22.0
Total Split (%)	45.0%	45.0%	18.3%	55.0%	36.7%	36.7%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag			Lead		Lag	Lag
Lead-Lag Optimize?						
Recall Mode	None	None	None	None	Max	Max
Act Effct Green (s)	15.6	15.6	6.1	24.1	18.4	18.4
Actuated g/C Ratio	0.31	0.31	0.12	0.48	0.37	0.37
v/c Ratio	0.70	0.05	0.33	0.42	0.44	0.51
Control Delay	23.5	0.1	28.2	11.1	18.0	4.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	23.5	0.1	28.2	11.1	18.0	4.7
LOS	C	A	C	B	B	A
Approach Delay	22.0			13.9	10.2	
Approach LOS	C			B	B	
Queue Length 50th (ft)	107	0	22	65	79	0
Queue Length 95th (ft)	178	0	39	141	162	57
Internal Link Dist (ft)	140			302	674	
Turn Bay Length (ft)						450
Base Capacity (vph)	783	804	224	1038	677	845
Starvation Cap Reductn	0	0	0	0	0	0

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.48	0.03	0.32	0.35	0.44	0.51

Intersection Summary	
Area Type: Other	
Cycle Length: 60	
Actuated Cycle Length: 50.1	
Natural Cycle: 55	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 0.70	
Intersection Signal Delay: 14.3	Intersection LOS: B
Intersection Capacity Utilization 49.9%	ICU Level of Service A
Analysis Period (min) 15	

Splits and Phases: 3: J. P. Leong Hwy/Kamehameha Hwy



Intersection	
Intersection Delay (sec/veh):	$ 506.1

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Volume (vph)	42	102	386	152	508	455
Conflicting Peds.(#/hr)	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
Right Turn Channelized	Yield	Yield	Yield	Yield	None	None
Storage Length	0	0		200	0	
Median Width	12		0			0
Grade (%)	0%		0%			0%
Peak Hour Factor	0.75	0.85	0.97	0.83	0.77	1.00
Heavy Vehicles(%)	6	7	5	4	2	3
Movement Flow Rate	56	120	398	183	660	455
Number of Lanes	1	0	1	1	0	1

Major/Minor			Major 1			Major 2
Conflicting Flow Rate - All	2265	291	0	0	581	0
Stage 1	490	-	-	-	-	-
Stage 2	1775	-	-	-	-	-
Follow-up Headway	3.554	3.363	-	-	2.218	-
Pot Capacity-1 Maneuver	# 44	736	-	-	993	-
Stage 1	608	-	-	-	-	-
Stage 2	145	-	-	-	-	-
Time blocked-Platoon(%)	0	0	-	-	0	-
Mov Capacity-1 Maneuver	# 5	736	-	-	993	-
Mov Capacity-2 Maneuver	# 5	-	-	-	-	-
Stage 1	608	-	-	-	-	-
Stage 2	# 16	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay (s)	$ 5324.5	0	9.2
HCM LOS	F	A	A

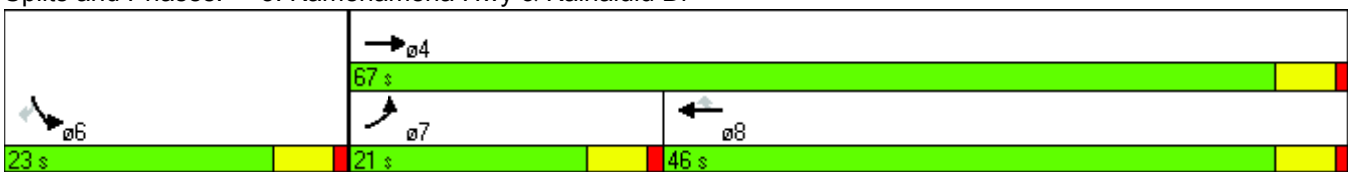
Lane	NBT	NBR	WBLn1	SBL	SBT
Capacity (vph)			15		
HCM Control Delay (s)	-	-	$ 5324.5	15.49	-
HCM Lane VC Ratio	-	-	11.733	0.664	-
HCM Lane LOS	-	-	F	C	-
HCM 95th Percentile Queue (veh)	-	-	22.995	5.272	-

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	163	464	515	51	45	158
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)	300			400	0	200
Storage Lanes	1			1	1	1
Taper Length (ft)	100				100	
Satd. Flow (prot)	1770	1845	1810	1495	1736	1509
Flt Permitted	0.950				0.950	
Satd. Flow (perm)	1770	1845	1810	1495	1736	1509
Right Turn on Red				Yes		Yes
Satd. Flow (RTOR)				85		172
Link Speed (mph)		45	45		30	
Link Distance (ft)		500	3000		500	
Travel Time (s)		7.6	45.5		11.4	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	2%	3%	5%	8%	4%	7%
Shared Lane Traffic (%)						
Lane Group Flow (vph)	177	504	560	55	49	172
Turn Type	Prot	NA	NA	Perm	NA	Perm
Protected Phases	7	4	8		6	
Permitted Phases				8		6
Detector Phase	7	4	8	8	6	6
Switch Phase						
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	10.0	22.0	22.0	22.0	22.0	22.0
Total Split (s)	21.0	67.0	46.0	46.0	23.0	23.0
Total Split (%)	23.3%	74.4%	51.1%	51.1%	25.6%	25.6%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead		Lag	Lag		
Lead-Lag Optimize?						
Recall Mode	None	None	None	None	Max	Max
Act Effct Green (s)	12.2	45.4	28.0	28.0	18.5	18.5
Actuated g/C Ratio	0.16	0.61	0.38	0.38	0.25	0.25
v/c Ratio	0.61	0.45	0.82	0.09	0.11	0.34
Control Delay	40.1	8.5	31.4	1.8	27.1	7.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	40.1	8.5	31.4	1.8	27.1	7.3
LOS	D	A	C	A	C	A
Approach Delay		16.7	28.8		11.7	
Approach LOS		B	C		B	
Queue Length 50th (ft)	76	106	224	0	18	0
Queue Length 95th (ft)	160	158	361	10	54	52
Internal Link Dist (ft)		420	2920		420	
Turn Bay Length (ft)	300			400		200
Base Capacity (vph)	392	1554	1027	885	432	505
Starvation Cap Reductn	0	0	0	0	0	0

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.45	0.32	0.55	0.06	0.11	0.34

Intersection Summary	
Area Type: Other	
Cycle Length: 90	
Actuated Cycle Length: 74.1	
Natural Cycle: 60	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 0.82	
Intersection Signal Delay: 20.9	Intersection LOS: C
Intersection Capacity Utilization 52.0%	ICU Level of Service A
Analysis Period (min) 15	

Splits and Phases: 3: Kamehameha Hwy & Kaihalulu Dr



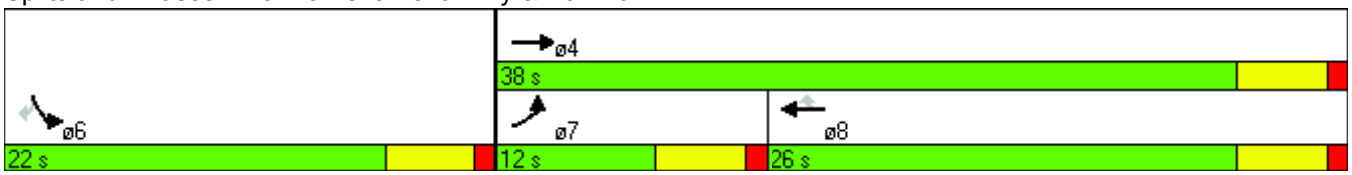
Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	120	389	453	191	148	113
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)	200			400	0	0
Storage Lanes	1			1	1	1
Taper Length (ft)	100				100	
Satd. Flow (prot)	1741	1815	1781	1471	1715	1503
Flt Permitted	0.950				0.950	
Satd. Flow (perm)	1741	1815	1781	1443	1705	1482
Right Turn on Red				Yes		Yes
Satd. Flow (RTOR)				208		127
Link Speed (mph)		45	45		25	
Link Distance (ft)		500	5500		500	
Travel Time (s)		7.6	83.3		13.6	
Confl. Peds. (#/hr)					3	1
Confl. Bikes (#/hr)				12		1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	2%	3%	5%	8%	4%	7%
Bus Blockages (#/hr)	4	4	4	4	3	1
Shared Lane Traffic (%)						
Lane Group Flow (vph)	130	423	492	208	161	123
Turn Type	Prot	NA	NA	Perm	NA	Perm
Protected Phases	7	4	8		6	
Permitted Phases				8		6
Detector Phase	7	4	8	8	6	6
Switch Phase						
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	9.0	21.0	21.0	21.0	21.0	21.0
Total Split (s)	12.0	38.0	26.0	26.0	22.0	22.0
Total Split (%)	20.0%	63.3%	43.3%	43.3%	36.7%	36.7%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead		Lag	Lag		
Lead-Lag Optimize?						
Recall Mode	None	None	None	None	Min	Min
Act Effct Green (s)	7.3	26.3	17.7	17.7	10.2	10.2
Actuated g/C Ratio	0.15	0.55	0.37	0.37	0.21	0.21
v/c Ratio	0.49	0.42	0.74	0.31	0.44	0.29
Control Delay	31.1	7.4	23.1	3.8	22.5	6.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	31.1	7.4	23.1	3.8	22.5	6.2
LOS	C	A	C	A	C	A
Approach Delay		13.0	17.4		15.4	
Approach LOS		B	B		B	
Queue Length 50th (ft)	39	55	124	0	45	0
Queue Length 95th (ft)	#108	122	#281	35	91	32
Internal Link Dist (ft)		420	5420		420	

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Turn Bay Length (ft)	200			400		
Base Capacity (vph)	280	1273	860	804	670	656
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.46	0.33	0.57	0.26	0.24	0.19

Intersection Summary

Area Type: Other
Cycle Length: 60
Actuated Cycle Length: 47.5
Natural Cycle: 60
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.74
Intersection Signal Delay: 15.4 Intersection LOS: B
Intersection Capacity Utilization 51.4% ICU Level of Service A
Analysis Period (min) 15
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 5: Kamehameha Hwy & Kuilima Dr



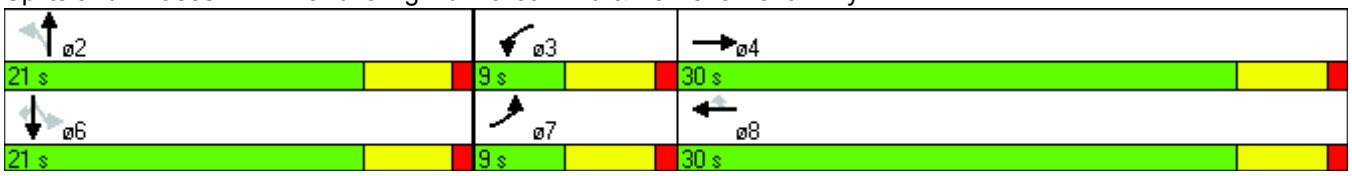
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	40	473	24	28	565	35	24	0	20	47	0	55
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	200		0	330		400	0		0	0		200
Storage Lanes	1		0	1		1	0		0	0		1
Taper Length (ft)	100			100			100			100		
Satd. Flow (prot)	1805	1794	0	1203	1812	1615	0	1157	0	0	1805	1615
Flt Permitted	0.950			0.950				0.803			0.726	
Satd. Flow (perm)	1805	1794	0	1203	1812	1568	0	954	0	0	1379	1615
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		5				127		127				127
Link Speed (mph)		45			45			30			25	
Link Distance (ft)		500			1200			500			500	
Travel Time (s)		7.6			18.2			11.4			13.6	
Confl. Bikes (#/hr)						10						
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	0%	2%	50%	50%	4%	0%	50%	2%	50%	0%	2%	0%
Bus Blockages (#/hr)	0	2	0	0	2	0	0	0	0	0	0	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	43	540	0	30	614	38	0	48	0	0	51	60
Turn Type	Prot	NA		Prot	NA	Perm	Perm	NA		Perm	NA	Perm
Protected Phases	7	4		3	8			2			6	
Permitted Phases						8	2			6		6
Detector Phase	7	4		3	8	8	2	2		6	6	6
Switch Phase												
Minimum Initial (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Minimum Split (s)	9.0	21.0		9.0	21.0	21.0	21.0	21.0		21.0	21.0	21.0
Total Split (s)	9.0	30.0		9.0	30.0	30.0	21.0	21.0		21.0	21.0	21.0
Total Split (%)	15.0%	50.0%		15.0%	50.0%	50.0%	35.0%	35.0%		35.0%	35.0%	35.0%
Yellow Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
All-Red Time (s)	1.0	1.0		1.0	1.0	1.0	1.0	1.0		1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0		0.0	0.0	0.0		0.0			0.0	0.0
Total Lost Time (s)	5.0	5.0		5.0	5.0	5.0		5.0			5.0	5.0
Lead/Lag	Lead	Lag		Lead	Lag	Lag						
Lead-Lag Optimize?												
Recall Mode	None	None		None	None	None	Min	Min		Min	Min	Min
Act Effct Green (s)	4.3	18.3		4.3	18.3	18.3		7.5			7.5	7.5
Actuated g/C Ratio	0.11	0.47		0.11	0.47	0.47		0.19			0.19	0.19
v/c Ratio	0.22	0.65		0.23	0.73	0.05		0.17			0.19	0.15
Control Delay	24.1	13.1		26.1	15.9	0.1		1.3			19.2	1.5
Queue Delay	0.0	0.0		0.0	0.0	0.0		0.0			0.0	0.0
Total Delay	24.1	13.1		26.1	15.9	0.1		1.3			19.2	1.5
LOS	C	B		C	B	A		A			B	A
Approach Delay		13.9			15.4			1.3			9.7	
Approach LOS		B			B			A			A	
Queue Length 50th (ft)	7	58		5	71	0		0			8	0
Queue Length 95th (ft)	39	212		#34	#265	0		0			39	6
Internal Link Dist (ft)		420			1120			420			420	
Turn Bay Length (ft)	200			330		400						200

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Base Capacity (vph)	199	1300		133	1312	1170		492			609	784
Starvation Cap Reductn	0	0		0	0	0		0			0	0
Spillback Cap Reductn	0	0		0	0	0		0			0	0
Storage Cap Reductn	0	0		0	0	0		0			0	0
Reduced v/c Ratio	0.22	0.42		0.23	0.47	0.03		0.10			0.08	0.08

Intersection Summary

Area Type: Other
Cycle Length: 60
Actuated Cycle Length: 39.3
Natural Cycle: 60
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.73
Intersection Signal Delay: 13.9 Intersection LOS: B
Intersection Capacity Utilization 50.8% ICU Level of Service A
Analysis Period (min) 15
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 7: Kahuku Ag Rd/Marconi Rd & Kamehameha Hwy



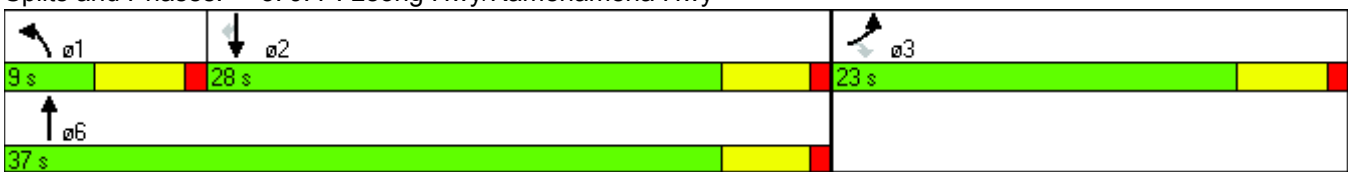
Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	410	18	43	494	451	487
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0	0	0			450
Storage Lanes	1	1	1			1
Taper Length (ft)	100		100			
Satd. Flow (prot)	1787	1615	1805	1900	1810	1583
Flt Permitted	0.950		0.950			
Satd. Flow (perm)	1787	1615	1805	1900	1810	1583
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)		127				497
Link Speed (mph)	30			30	30	
Link Distance (ft)	220			382	754	
Travel Time (s)	5.0			8.7	17.1	
Peak Hour Factor	0.98	1.00	1.00	1.00	0.86	0.98
Heavy Vehicles (%)	1%	0%	0%	0%	5%	2%
Shared Lane Traffic (%)						
Lane Group Flow (vph)	418	18	43	494	524	497
Turn Type	NA	Perm	Prot	NA	NA	Perm
Protected Phases	3		1	6	2	
Permitted Phases		3				2
Detector Phase	3	3	1	6	2	2
Switch Phase						
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	21.0	21.0	9.0	9.0	21.0	21.0
Total Split (s)	23.0	23.0	9.0	37.0	28.0	28.0
Total Split (%)	38.3%	38.3%	15.0%	61.7%	46.7%	46.7%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag			Lead		Lag	Lag
Lead-Lag Optimize?						
Recall Mode	None	None	None	None	Max	Max
Act Effct Green (s)	15.8	15.8	4.1	26.7	23.6	23.6
Actuated g/C Ratio	0.30	0.30	0.08	0.51	0.45	0.45
v/c Ratio	0.78	0.03	0.31	0.51	0.65	0.51
Control Delay	30.2	0.1	31.8	11.2	18.5	3.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	30.2	0.1	31.8	11.2	18.5	3.6
LOS	C	A	C	B	B	A
Approach Delay	28.9			12.8	11.3	
Approach LOS	C			B	B	
Queue Length 50th (ft)	102	0	12	98	109	0
Queue Length 95th (ft)	#267	0	42	169	#252	51
Internal Link Dist (ft)	140			302	674	
Turn Bay Length (ft)						450
Base Capacity (vph)	620	643	139	1172	810	983
Starvation Cap Reductn	0	0	0	0	0	0

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.67	0.03	0.31	0.42	0.65	0.51

Intersection Summary	
Area Type: Other	
Cycle Length: 60	
Actuated Cycle Length: 52.6	
Natural Cycle: 60	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 0.78	
Intersection Signal Delay: 15.5	Intersection LOS: B
Intersection Capacity Utilization 62.3%	ICU Level of Service B
Analysis Period (min) 15	

\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 3: J. P. Leong Hwy/Kamehameha Hwy



Intersection	
Intersection Delay (sec/veh):	13.1

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Volume (vph)	61	295	780	77	93	709
Conflicting Peds.(#/hr)	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
Right Turn Channelized	Yield	Yield	Yield	Yield	None	None
Storage Length	0	0		200	0	
Median Width	12		0			0
Grade (%)	0%		0%			0%
Peak Hour Factor	0.95	0.98	0.96	0.84	1.00	1.00
Heavy Vehicles(%)	6	5	3	5	3	2
Movement Flow Rate	64	301	813	92	93	709
Number of Lanes	1	0	1	1	0	1

Major/Minor			Major 1			Major 2
Conflicting Flow Rate - All	1754	453	0	0	905	0
Stage 1	859	-	-	-	-	-
Stage 2	895	-	-	-	-	-
Follow-up Headway	3.554	3.345	-	-	2.227	-
Pot Capacity-1 Maneuver	92	601	-	-	747	-
Stage 1	408	-	-	-	-	-
Stage 2	393	-	-	-	-	-
Time blocked-Platoon(%)	0	0	-	-	0	-
Mov Capacity-1 Maneuver	73	601	-	-	747	-
Mov Capacity-2 Maneuver	73	-	-	-	-	-
Stage 1	408	-	-	-	-	-
Stage 2	312	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay (s)	71.7	0	1.2
HCM LOS	F	A	A

Lane	NBT	NBR	WBLn1	SBL	SBT
Capacity (vph)			378		
HCM Control Delay (s)	-	-	71.7	10.503	-
HCM Lane VC Ratio	-	-	0.966	0.124	-
HCM Lane LOS	-	-	F	B	-
HCM 95th Percentile Queue (veh)	-	-	10.932	0.424	-

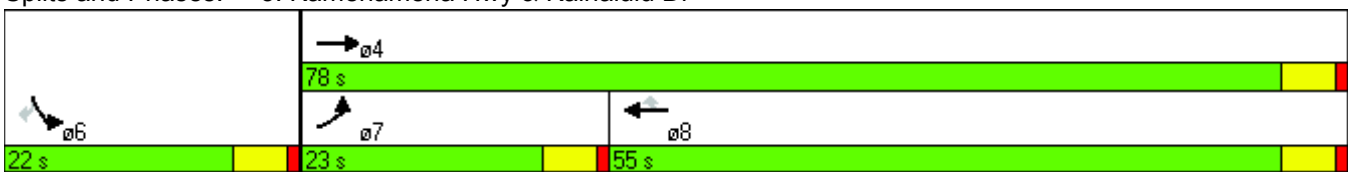
Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	209	599	642	59	74	231
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)	300			400	0	200
Storage Lanes	1			1	1	1
Taper Length (ft)	100				100	
Satd. Flow (prot)	1752	1863	1810	1553	1752	1583
Flt Permitted	0.950				0.950	
Satd. Flow (perm)	1752	1863	1810	1553	1752	1583
Right Turn on Red				Yes		Yes
Satd. Flow (RTOR)				76		251
Link Speed (mph)		45	45		30	
Link Distance (ft)		500	3000		500	
Travel Time (s)		7.6	45.5		11.4	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	3%	2%	5%	4%	3%	2%
Shared Lane Traffic (%)						
Lane Group Flow (vph)	227	651	698	64	80	251
Turn Type	Prot	NA	NA	Perm	NA	Perm
Protected Phases	7	4	8		6	
Permitted Phases				8		6
Detector Phase	7	4	8	8	6	6
Switch Phase						
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	10.0	22.0	22.0	22.0	22.0	22.0
Total Split (s)	23.0	78.0	55.0	55.0	22.0	22.0
Total Split (%)	23.0%	78.0%	55.0%	55.0%	22.0%	22.0%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead		Lag	Lag		
Lead-Lag Optimize?						
Recall Mode	None	None	None	None	Max	Max
Act Effct Green (s)	15.2	58.2	37.9	37.9	17.4	17.4
Actuated g/C Ratio	0.18	0.68	0.44	0.44	0.20	0.20
v/c Ratio	0.73	0.52	0.88	0.09	0.23	0.48
Control Delay	50.4	8.1	34.9	2.9	35.4	8.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	50.4	8.1	34.9	2.9	35.4	8.4
LOS	D	A	C	A	D	A
Approach Delay		19.0	32.2		14.9	
Approach LOS		B	C		B	
Queue Length 50th (ft)	120	146	340	0	39	0
Queue Length 95th (ft)	#241	211	504	17	88	66
Internal Link Dist (ft)		420	2920		420	
Turn Bay Length (ft)	300			400		200
Base Capacity (vph)	376	1577	1081	958	355	521
Starvation Cap Reductn	0	0	0	0	0	0

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.60	0.41	0.65	0.07	0.23	0.48

Intersection Summary

Area Type: Other
Cycle Length: 100
Actuated Cycle Length: 85.9
Natural Cycle: 75
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.88
Intersection Signal Delay: 23.4 Intersection LOS: C
Intersection Capacity Utilization 62.0% ICU Level of Service B
Analysis Period (min) 15
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 3: Kamehameha Hwy & Kaihalulu Dr



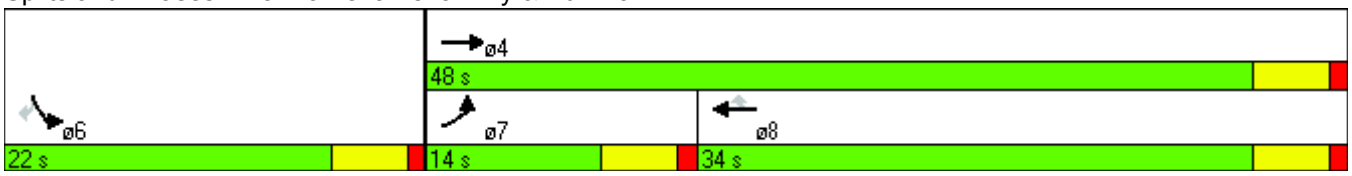
Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	142	531	543	198	200	155
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)	200			400	0	0
Storage Lanes	1			1	1	1
Taper Length (ft)	100				100	
Satd. Flow (prot)	1738	1848	1795	1540	1738	1571
Flt Permitted	0.950				0.950	
Satd. Flow (perm)	1738	1848	1795	1512	1738	1550
Right Turn on Red				Yes		Yes
Satd. Flow (RTOR)				215		168
Link Speed (mph)		45	45		25	
Link Distance (ft)		500	5500		500	
Travel Time (s)		7.6	83.3		13.6	
Confl. Bikes (#/hr)				12		1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	3%	2%	5%	4%	3%	2%
Bus Blockages (#/hr)	2	2	2	2	2	2
Shared Lane Traffic (%)						
Lane Group Flow (vph)	154	577	590	215	217	168
Turn Type	Prot	NA	NA	Perm	NA	Perm
Protected Phases	7	4	8		6	
Permitted Phases				8		6
Detector Phase	7	4	8	8	6	6
Switch Phase						
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	9.0	21.0	21.0	21.0	21.0	21.0
Total Split (s)	14.0	48.0	34.0	34.0	22.0	22.0
Total Split (%)	20.0%	68.6%	48.6%	48.6%	31.4%	31.4%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead		Lag	Lag		
Lead-Lag Optimize?						
Recall Mode	None	None	None	None	Max	Max
Act Effct Green (s)	8.6	39.0	25.4	25.4	17.1	17.1
Actuated g/C Ratio	0.13	0.59	0.38	0.38	0.26	0.26
v/c Ratio	0.68	0.53	0.86	0.30	0.48	0.32
Control Delay	46.3	10.0	32.9	3.4	26.5	6.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	46.3	10.0	32.9	3.4	26.5	6.0
LOS	D	B	C	A	C	A
Approach Delay		17.7	25.1		17.6	
Approach LOS		B	C		B	
Queue Length 50th (ft)	64	122	214	0	81	0
Queue Length 95th (ft)	#145	194	#383	36	144	43
Internal Link Dist (ft)		420	5420		420	
Turn Bay Length (ft)	200			400		

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Base Capacity (vph)	238	1208	791	787	449	525
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.65	0.48	0.75	0.27	0.48	0.32

Intersection Summary	
Area Type: Other	
Cycle Length: 70	
Actuated Cycle Length: 66.2	
Natural Cycle: 60	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 0.86	
Intersection Signal Delay: 20.7	Intersection LOS: C
Intersection Capacity Utilization 60.0%	ICU Level of Service B
Analysis Period (min) 15	

\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 5: Kamehameha Hwy & Kuilima Dr



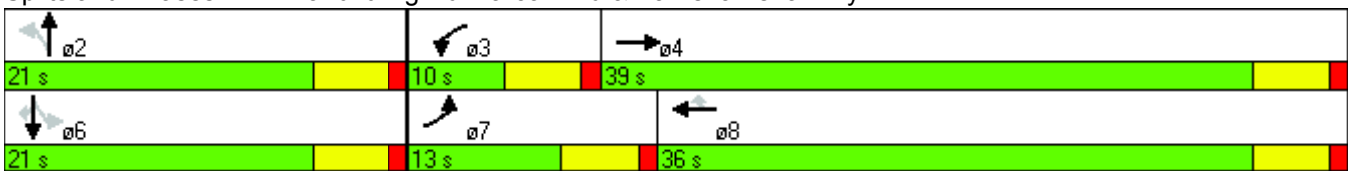
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	118	595	18	18	624	98	16	0	16	73	0	104
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	200		0	330		400	0		0	0		200
Storage Lanes	1		0	1		1	0		0	0		1
Taper Length (ft)	100			100			100			100		
Satd. Flow (prot)	1805	1815	0	1203	1812	1615	0	1152	0	0	1805	1615
Flt Permitted	0.950			0.950				0.828			0.735	
Satd. Flow (perm)	1805	1815	0	1203	1812	1569	0	977	0	0	1396	1615
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		3				109		109				113
Link Speed (mph)		45			45			30			25	
Link Distance (ft)		500			1200			500			500	
Travel Time (s)		7.6			18.2			11.4			13.6	
Confl. Bikes (#/hr)						10						
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	0%	2%	50%	50%	4%	0%	50%	2%	50%	0%	2%	0%
Bus Blockages (#/hr)	0	2	0	0	2	0	0	0	0	0	0	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	128	667	0	20	678	107	0	34	0	0	79	113
Turn Type	Prot	NA		Prot	NA	Perm	Perm	NA		Perm	NA	Perm
Protected Phases	7	4		3	8			2			6	
Permitted Phases						8	2			6		6
Detector Phase	7	4		3	8	8	2	2		6	6	6
Switch Phase												
Minimum Initial (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Minimum Split (s)	9.0	21.0		9.0	21.0	21.0	21.0	21.0		21.0	21.0	21.0
Total Split (s)	13.0	39.0		10.0	36.0	36.0	21.0	21.0		21.0	21.0	21.0
Total Split (%)	18.6%	55.7%		14.3%	51.4%	51.4%	30.0%	30.0%		30.0%	30.0%	30.0%
Yellow Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
All-Red Time (s)	1.0	1.0		1.0	1.0	1.0	1.0	1.0		1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0		0.0	0.0	0.0		0.0			0.0	0.0
Total Lost Time (s)	5.0	5.0		5.0	5.0	5.0		5.0			5.0	5.0
Lead/Lag	Lead	Lag		Lead	Lag	Lag						
Lead-Lag Optimize?												
Recall Mode	None	None		None	None	None	Min	Min		Min	Min	Min
Act Effct Green (s)	8.1	32.8		5.5	25.1	25.1		9.1			9.1	9.1
Actuated g/C Ratio	0.15	0.60		0.10	0.46	0.46		0.17			0.17	0.17
v/c Ratio	0.48	0.61		0.16	0.81	0.14		0.13			0.34	0.31
Control Delay	33.4	10.5		31.7	23.7	2.9		1.1			28.0	8.3
Queue Delay	0.0	0.0		0.0	0.0	0.0		0.0			0.0	0.0
Total Delay	33.4	10.5		31.7	23.7	2.9		1.1			28.0	8.3
LOS	C	B		C	C	A		A			C	A
Approach Delay		14.2			21.1			1.1			16.4	
Approach LOS		B			C			A			B	
Queue Length 50th (ft)	45	93		7	194	0		0			27	0
Queue Length 95th (ft)	#114	318		28	#413	22		0			63	37
Internal Link Dist (ft)		420			1120			420			420	
Turn Bay Length (ft)	200			330		400						200

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Base Capacity (vph)	293	1291		122	1103	997		390			453	600
Starvation Cap Reductn	0	0		0	0	0		0			0	0
Spillback Cap Reductn	0	0		0	0	0		0			0	0
Storage Cap Reductn	0	0		0	0	0		0			0	0
Reduced v/c Ratio	0.44	0.52		0.16	0.61	0.11		0.09			0.17	0.19

Intersection Summary

Area Type: Other
Cycle Length: 70
Actuated Cycle Length: 54.6
Natural Cycle: 60
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.81
Intersection Signal Delay: 17.2 Intersection LOS: B
Intersection Capacity Utilization 60.4% ICU Level of Service B
Analysis Period (min) 15
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 7: Kahuku Ag Rd/Marconi Rd & Kamehameha Hwy



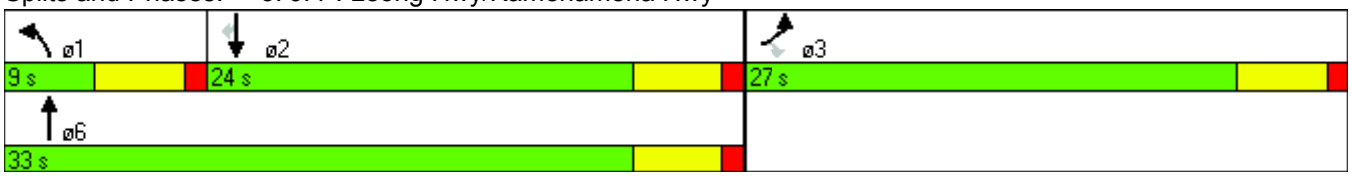
Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	461	41	76	594	473	538
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0	0	0			450
Storage Lanes	1	1	1			1
Taper Length (ft)	100		100			
Satd. Flow (prot)	1787	1615	1805	1845	1881	1583
Flt Permitted	0.950		0.950			
Satd. Flow (perm)	1787	1615	1805	1845	1881	1583
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)		127				611
Link Speed (mph)	30			30	30	
Link Distance (ft)	220			382	754	
Travel Time (s)	5.0			8.7	17.1	
Peak Hour Factor	0.83	0.68	1.00	1.00	0.96	0.88
Heavy Vehicles (%)	1%	0%	0%	3%	1%	2%
Shared Lane Traffic (%)						
Lane Group Flow (vph)	555	60	76	594	493	611
Turn Type	NA	Perm	Prot	NA	NA	Perm
Protected Phases	3		1	6	2	
Permitted Phases		3				2
Detector Phase	3	3	1	6	2	2
Switch Phase						
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	21.0	21.0	9.0	9.0	21.0	21.0
Total Split (s)	27.0	27.0	9.0	33.0	24.0	24.0
Total Split (%)	45.0%	45.0%	15.0%	55.0%	40.0%	40.0%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag			Lead		Lag	Lag
Lead-Lag Optimize?						
Recall Mode	None	None	None	None	Max	Max
Act Effct Green (s)	20.2	20.2	4.1	26.1	19.3	19.3
Actuated g/C Ratio	0.36	0.36	0.07	0.46	0.34	0.34
v/c Ratio	0.87	0.09	0.58	0.70	0.77	0.65
Control Delay	34.4	0.7	49.1	17.7	28.8	5.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	34.4	0.7	49.1	17.7	28.8	5.5
LOS	C	A	D	B	C	A
Approach Delay	31.1			21.2	15.9	
Approach LOS	C			C	B	
Queue Length 50th (ft)	179	0	28	158	163	0
Queue Length 95th (ft)	#298	0	#84	264	#312	57
Internal Link Dist (ft)	140			302	674	
Turn Bay Length (ft)						450
Base Capacity (vph)	708	716	130	930	643	943
Starvation Cap Reductn	0	0	0	0	0	0

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.78	0.08	0.58	0.64	0.77	0.65

Intersection Summary	
Area Type: Other	
Cycle Length: 60	
Actuated Cycle Length: 56.5	
Natural Cycle: 60	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 0.87	
Intersection Signal Delay: 21.3	Intersection LOS: C
Intersection Capacity Utilization 67.1%	ICU Level of Service C
Analysis Period (min) 15	

\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 3: J. P. Leong Hwy/Kamehameha Hwy



Intersection	
Intersection Delay (sec/veh):	89.7

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Volume (vph)	56	297	853	92	96	868
Conflicting Peds.(#/hr)	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
Right Turn Channelized	Yield	Yield	Yield	Yield	None	None
Storage Length	0	0		200	0	
Median Width	12		0			0
Grade (%)	0%		0%			0%
Peak Hour Factor	1.00	1.00	0.91	0.79	0.78	0.93
Heavy Vehicles(%)	7	2	2	6	4	3
Movement Flow Rate	56	297	937	116	123	933
Number of Lanes	1	0	1	1	0	1

Major/Minor			Major 1			Major 2
Conflicting Flow Rate - All	2174	527	0	0	1053	0
Stage 1	995	-	-	-	-	-
Stage 2	1179	-	-	-	-	-
Follow-up Headway	3.563	3.318	-	-	2.236	-
Pot Capacity-1 Maneuver	# 49	551	-	-	653	-
Stage 1	350	-	-	-	-	-
Stage 2	285	-	-	-	-	-
Time blocked-Platoon(%)	0	0	-	-	0	-
Mov Capacity-1 Maneuver	# 30	551	-	-	653	-
Mov Capacity-2 Maneuver	# 30	-	-	-	-	-
Stage 1	350	-	-	-	-	-
Stage 2	174	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay (s)	$ 621.7	0	1.4
HCM LOS	F	A	A

Lane	NBT	NBR	WBLn1	SBL	SBT
Capacity (vph)			158		
HCM Control Delay (s)	-	-	$ 621.7	11.789	-
HCM Lane VC Ratio	-	-	2.234	0.188	-
HCM Lane LOS	-	-	F	B	-
HCM 95th Percentile Queue (veh)	-	-	28.948	0.69	-

HCS+: Two-Lane Highways Release 5.4

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Two-Way Two-Lane Highway Segment Analysis

Analyst	RSO
Agency/Co.	Traffic Management Consultant
Date Performed	11/3/11
Analysis Time Period	AM Peak Hr W/Conservation Alt
Highway	Kamehameha Highway
From/To	West of Kaihalulu Drive
Jurisdiction	
Analysis Year	2025
Description	Turtle Bay Resort Master Plan

Input Data

Highway class	Class 1				
Shoulder width	6.0	ft	Peak-hour factor, PHF	0.92	
Lane width	12.0	ft	% Trucks and buses	8	%
Segment length	0.0	mi	% Recreational vehicles	0	%
Terrain type	Level		% No-passing zones	50	%
Grade: Length		mi	Access points/mi	2	/mi
Up/down		%			

Two-way hourly volume, V	1088	veh/h	
Directional split	50 / 50	%	

Average Travel Speed

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.1	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor,	0.992	
Two-way flow rate,(note-1) vp	1192	pc/h
Highest directional split proportion (note-2)	596	pc/h

Free-Flow Speed from Field Measurement:		
Field measured speed, SFM	-	mi/h
Observed volume, Vf	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed, BFFS	45.0	mi/h
Adj. for lane and shoulder width, fLS	0.0	mi/h
Adj. for access points, fA	0.5	mi/h
Free-flow speed, FFS	44.5	mi/h

Adjustment for no-passing zones, fnp	1.4	mi/h
Average travel speed, ATS	33.8	mi/h

Percent Time-Spent-Following

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.1	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor, fHV	0.992	
Two-way flow rate,(note-1) vp	1192	pc/h
Highest directional split proportion (note-2)	596	
Base percent time-spent-following, BPTSF	64.9	%
Adj.for directional distribution and no-passing zones, fd/np	8.6	
Percent time-spent-following, PTSF	73.5	%

Level of Service and Other Performance Measures

Level of service, LOS	E	
Volume to capacity ratio, v/c	0.37	
Peak 15-min vehicle-miles of travel, VMT15	0	veh-mi
Peak-hour vehicle-miles of travel, VMT60	0	veh-mi
Peak 15-min total travel time, TT15	0.0	veh-h

Notes:
1. If vp >= 3200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split vp >= 1700 pc/h, terminate analysis-the LOS is F.

HCS+: Two-Lane Highways Release 5.4

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Two-Way Two-Lane Highway Segment Analysis

Analyst	RSO
Agency/Co.	Traffic Management Consultant
Date Performed	11/1/2011
Analysis Time Period	AM Peak Hr W/Conservation Alt
Highway	Kamehameha Highway
From/To	Haleiwa to Kawailoa
Jurisdiction	
Analysis Year	2025
Description	Turtle Bay Resort Master Plan

Input Data

Highway class	Class 1				
Shoulder width	6.0	ft	Peak-hour factor, PHF	0.95	
Lane width	12.0	ft	% Trucks and buses	5	%
Segment length	0.0	mi	% Recreational vehicles	0	%
Terrain type	Level		% No-passing zones	80	%
Grade: Length		mi	Access points/mi	2	/mi
Up/down		%			

Two-way hourly volume, V	1384	veh/h	
Directional split	51 / 49	%	

Average Travel Speed

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.1	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor,	0.995	
Two-way flow rate,(note-1) vp	1464	pc/h
Highest directional split proportion (note-2)	747	pc/h
Free-Flow Speed from Field Measurement:		
Field measured speed, SFM	-	mi/h
Observed volume, Vf	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed, BFFS	45.0	mi/h
Adj. for lane and shoulder width, fLS	0.0	mi/h
Adj. for access points, fA	0.5	mi/h
Free-flow speed, FFS	44.5	mi/h
Adjustment for no-passing zones, fnp	1.4	mi/h

Average travel speed, ATS 31.8 mi/h

Percent Time-Spent-Following

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.0	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor, fHV	1.000	
Two-way flow rate,(note-1) vp	1457	pc/h
Highest directional split proportion (note-2)	743	
Base percent time-spent-following, BPTSF	72.2	%
Adj.for directional distribution and no-passing zones, fd/np	7.0	
Percent time-spent-following, PTSF	79.2	%

Level of Service and Other Performance Measures

Level of service, LOS	E	
Volume to capacity ratio, v/c	0.46	
Peak 15-min vehicle-miles of travel, VMT15	0	veh-mi
Peak-hour vehicle-miles of travel, VMT60	0	veh-mi
Peak 15-min total travel time, TT15	0.0	veh-h

Notes:
1. If vp >= 3200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split vp >= 1700 pc/h, terminate analysis-the LOS is F.

HCS+: Two-Lane Highways Release 5.4

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Two-Way Two-Lane Highway Segment Analysis

Analyst	RSO
Agency/Co.	Traffic Management Consultant
Date Performed	11/1/2011
Analysis Time Period	AM Peak Hr W/Conservation Alt
Highway	Kamehameha Highway
From/To	Hygienic Store
Jurisdiction	
Analysis Year	2025
Description	Turtle Bay Resort Master Plan

Input Data

Highway class	Class 1				
Shoulder width	6.0	ft	Peak-hour factor, PHF	0.89	
Lane width	12.0	ft	% Trucks and buses	3	%
Segment length	0.0	mi	% Recreational vehicles	0	%
Terrain type	Level		% No-passing zones	80	%
Grade: Length		mi	Access points/mi	10	/mi
Up/down		%			

Two-way hourly volume, V	1597	veh/h	
Directional split	65 / 35	%	

Average Travel Speed

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.1	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor,	0.997	
Two-way flow rate,(note-1) vp	1800	pc/h
Highest directional split proportion (note-2)	1170	pc/h
Free-Flow Speed from Field Measurement:		
Field measured speed, SFM	-	mi/h
Observed volume, Vf	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed, BFFS	45.0	mi/h
Adj. for lane and shoulder width, fLS	0.0	mi/h
Adj. for access points, fA	2.5	mi/h
Free-flow speed, FFS	42.5	mi/h
Adjustment for no-passing zones, fnp	1.1	mi/h

Average travel speed, ATS 27.4 mi/h

Percent Time-Spent-Following

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.0	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor, fHV	1.000	
Two-way flow rate,(note-1) vp	1794	pc/h
Highest directional split proportion (note-2)	1166	
Base percent time-spent-following, BPTSF	79.3	%
Adj.for directional distribution and no-passing zones, fd/np	5.3	
Percent time-spent-following, PTSF	84.6	%

Level of Service and Other Performance Measures

Level of service, LOS	E	
Volume to capacity ratio, v/c	0.56	
Peak 15-min vehicle-miles of travel, VMT15	0	veh-mi
Peak-hour vehicle-miles of travel, VMT60	0	veh-mi
Peak 15-min total travel time, TT15	0.0	veh-h

Notes:
1. If vp >= 3200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split vp >= 1700 pc/h, terminate analysis-the LOS is F.

HCS+: Two-Lane Highways Release 5.4

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Two-Way Two-Lane Highway Segment Analysis

Analyst	RSO
Agency/Co.	Traffic Management Consultant
Date Performed	11/3/11
Analysis Time Period	PM Peak Hr W/Conservation Alt
Highway	Kamehameha Highway
From/To	West of Kaihalulu Drive
Jurisdiction	
Analysis Year	2025
Description	Turtle Bay Resort Master Plan

Input Data

Highway class	Class 1				
Shoulder width	6.0	ft	Peak-hour factor, PHF	0.92	
Lane width	12.0	ft	% Trucks and buses	4	%
Segment length	0.0	mi	% Recreational vehicles	0	%
Terrain type	Level		% No-passing zones	50	%
Grade: Length		mi	Access points/mi	2	/mi
Up/down		%			

Two-way hourly volume, V	1300	veh/h	
Directional split	52 / 48	%	

Average Travel Speed

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.1	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor,	0.996	
Two-way flow rate,(note-1) vp	1419	pc/h
Highest directional split proportion (note-2)	738	pc/h
Free-Flow Speed from Field Measurement:		
Field measured speed, SFM	-	mi/h
Observed volume, Vf	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed, BFFS	45.0	mi/h
Adj. for lane and shoulder width, fLS	0.0	mi/h
Adj. for access points, fA	0.5	mi/h
Free-flow speed, FFS	44.5	mi/h
Adjustment for no-passing zones, fnp	1.0	mi/h

Average travel speed, ATS 32.4 mi/h

Percent Time-Spent-Following

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.0	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor, fHV	1.000	
Two-way flow rate,(note-1) vp	1413	pc/h
Highest directional split proportion (note-2)	735	
Base percent time-spent-following, BPTSF	71.1	%
Adj.for directional distribution and no-passing zones, fd/np	6.1	
Percent time-spent-following, PTSF	77.2	%

Level of Service and Other Performance Measures

Level of service, LOS	E	
Volume to capacity ratio, v/c	0.44	
Peak 15-min vehicle-miles of travel, VMT15	0	veh-mi
Peak-hour vehicle-miles of travel, VMT60	0	veh-mi
Peak 15-min total travel time, TT15	0.0	veh-h

Notes:
1. If vp >= 3200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split vp >= 1700 pc/h, terminate analysis-the LOS is F.

HCS+: Two-Lane Highways Release 5.4

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Two-Way Two-Lane Highway Segment Analysis

Analyst	RSO
Agency/Co.	Traffic Management Consultant
Date Performed	11/1/2011
Analysis Time Period	PM Peak Hour W/Resort Alt
Highway	Kamehameha Highway
From/To	Haleiwa to Kawailoa
Jurisdiction	
Analysis Year	2025
Description	Turtle Bay Resort Master Plan

Input Data

Highway class	Class 1				
Shoulder width	6.0	ft	Peak-hour factor, PHF	0.96	
Lane width	12.0	ft	% Trucks and buses	2	%
Segment length	0.0	mi	% Recreational vehicles	0	%
Terrain type	Level		% No-passing zones	80	%
Grade: Length		mi	Access points/mi	2	/mi
Up/down		%			

Two-way hourly volume, V	1842	veh/h	
Directional split	51 / 49	%	

Average Travel Speed

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.1	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor,	0.998	
Two-way flow rate,(note-1) vp	1923	pc/h
Highest directional split proportion (note-2)	981	pc/h
Free-Flow Speed from Field Measurement:		
Field measured speed, SFM	-	mi/h
Observed volume, Vf	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed, BFFS	45.0	mi/h
Adj. for lane and shoulder width, fLS	0.0	mi/h
Adj. for access points, fA	0.5	mi/h
Free-flow speed, FFS	44.5	mi/h
Adjustment for no-passing zones, fnp	1.0	mi/h

Average travel speed, ATS 28.5 mi/h

Percent Time-Spent-Following

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.0	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor, fHV	1.000	
Two-way flow rate,(note-1) vp	1919	pc/h
Highest directional split proportion (note-2)	979	
Base percent time-spent-following, BPTSF	81.5	%
Adj.for directional distribution and no-passing zones, fd/np	4.5	
Percent time-spent-following, PTSF	86.0	%

Level of Service and Other Performance Measures

Level of service, LOS	E	
Volume to capacity ratio, v/c	0.60	
Peak 15-min vehicle-miles of travel, VMT15	0	veh-mi
Peak-hour vehicle-miles of travel, VMT60	0	veh-mi
Peak 15-min total travel time, TT15	0.0	veh-h

Notes:
1. If vp >= 3200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split vp >= 1700 pc/h, terminate analysis-the LOS is F.

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Two-Way Two-Lane Highway Segment Analysis

Analyst	RSO
Agency/Co.	Traffic Management Consultant
Date Performed	11/1/2011
Analysis Time Period	PM Peak Hr W/Conservation Alt
Highway	Kamehameha Highway
From/To	Hygienic Store
Jurisdiction	
Analysis Year	2025
Description	Turtle Bay Resort Master Plan

Input Data

Highway class	Class 1				
Shoulder width	6.0	ft	Peak-hour factor, PHF	0.99	
Lane width	12.0	ft	% Trucks and buses	5	%
Segment length	0.0	mi	% Recreational vehicles	0	%
Terrain type	Level		% No-passing zones	80	%
Grade: Length		mi	Access points/mi	10	/mi
Up/down		%			

Two-way hourly volume, V	2040	veh/h	
Directional split	57 / 43	%	

Average Travel Speed

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.1	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor,	0.995	
Two-way flow rate,(note-1) vp	2071	pc/h
Highest directional split proportion (note-2)	1180	pc/h
Free-Flow Speed from Field Measurement:		
Field measured speed, SFM	-	mi/h
Observed volume, Vf	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed, BFFS	45.0	mi/h
Adj. for lane and shoulder width, fLS	0.0	mi/h
Adj. for access points, fA	2.5	mi/h
Free-flow speed, FFS	42.5	mi/h
Adjustment for no-passing zones, fnp	1.0	mi/h

Average travel speed, ATS 25.5 mi/h

Percent Time-Spent-Following

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.0	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor, fHV	1.000	
Two-way flow rate,(note-1) vp	2061	pc/h
Highest directional split proportion (note-2)	1175	
Base percent time-spent-following, BPTSF	83.7	%
Adj.for directional distribution and no-passing zones, fd/np	3.8	
Percent time-spent-following, PTSF	87.5	%

Level of Service and Other Performance Measures

Level of service, LOS	E	
Volume to capacity ratio, v/c	0.65	
Peak 15-min vehicle-miles of travel, VMT15	0	veh-mi
Peak-hour vehicle-miles of travel, VMT60	0	veh-mi
Peak 15-min total travel time, TT15	0.0	veh-h

Notes:
1. If vp >= 3200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split vp >= 1700 pc/h, terminate analysis-the LOS is F.

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Two-Way Two-Lane Highway Segment Analysis

Analyst	RSO
Agency/Co.	Traffic Management Consultant
Date Performed	11/5/11
Analysis Time Period	Sat Peak Hr W/Conservation Alt
Highway	Kamehameha Highway
From/To	West of Kaihalulu Drive
Jurisdiction	
Analysis Year	2025
Description	Turtle Bay Resort Master Plan

Input Data

Highway class	Class 1				
Shoulder width	6.0	ft	Peak-hour factor, PHF	0.92	
Lane width	12.0	ft	% Trucks and buses	3	%
Segment length	0.0	mi	% Recreational vehicles	0	%
Terrain type	Level		% No-passing zones	50	%
Grade: Length		mi	Access points/mi	2	/mi
Up/down		%			

Two-way hourly volume, V	1677	veh/h	
Directional split	52 / 48	%	

Average Travel Speed

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.1	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor,	0.997	
Two-way flow rate,(note-1) vp	1828	pc/h
Highest directional split proportion (note-2)	951	pc/h
Free-Flow Speed from Field Measurement:		
Field measured speed, SFM	-	mi/h
Observed volume, Vf	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed, BFFS	45.0	mi/h
Adj. for lane and shoulder width, fLS	0.0	mi/h
Adj. for access points, fA	0.5	mi/h
Free-flow speed, FFS	44.5	mi/h
Adjustment for no-passing zones, fnp	0.8	mi/h

Average travel speed, ATS 29.5 mi/h

Percent Time-Spent-Following

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.0	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor, fHV	1.000	
Two-way flow rate,(note-1) vp	1823	pc/h
Highest directional split proportion (note-2)	948	
Base percent time-spent-following, BPTSF	79.9	%
Adj.for directional distribution and no-passing zones, fd/np	4.2	
Percent time-spent-following, PTSF	84.0	%

Level of Service and Other Performance Measures

Level of service, LOS	E	
Volume to capacity ratio, v/c	0.57	
Peak 15-min vehicle-miles of travel, VMT15	0	veh-mi
Peak-hour vehicle-miles of travel, VMT60	0	veh-mi
Peak 15-min total travel time, TT15	0.0	veh-h

Notes:
1. If vp >= 3200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split vp >= 1700 pc/h, terminate analysis-the LOS is F.

HCS+: Two-Lane Highways Release 5.4

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Two-Way Two-Lane Highway Segment Analysis

Analyst	RSO
Agency/Co.	Traffic Management Consultant
Date Performed	10/29/2011
Analysis Time Period	Sat Peak Hr W/Conservation Alt
Highway	Kamehameha Highway
From/To	Haleiwa to Kawailoa
Jurisdiction	
Analysis Year	2025
Description	Turtle Bay Resort Master Plan

Input Data

Highway class	Class 1				
Shoulder width	6.0	ft	Peak-hour factor, PHF	0.92	
Lane width	12.0	ft	% Trucks and buses	2	%
Segment length	0.0	mi	% Recreational vehicles	0	%
Terrain type	Level		% No-passing zones	80	%
Grade: Length		mi	Access points/mi	2	/mi
Up/down		%			

Two-way hourly volume, V	2061	veh/h	
Directional split	51 / 49	%	

Average Travel Speed

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.1	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor,	0.998	
Two-way flow rate,(note-1) vp	2245	pc/h
Highest directional split proportion (note-2)	1145	pc/h
Free-Flow Speed from Field Measurement:		
Field measured speed, SFM	-	mi/h
Observed volume, Vf	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed, BFFS	45.0	mi/h
Adj. for lane and shoulder width, fLS	0.0	mi/h
Adj. for access points, fA	0.5	mi/h
Free-flow speed, FFS	44.5	mi/h
Adjustment for no-passing zones, fnp	0.9	mi/h

Average travel speed, ATS 26.2 mi/h

Percent Time-Spent-Following

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.0	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor, fHV	1.000	
Two-way flow rate,(note-1) vp	2240	pc/h
Highest directional split proportion (note-2)	1142	
Base percent time-spent-following, BPTSF	86.0	%
Adj.for directional distribution and no-passing zones, fd/np	3.4	
Percent time-spent-following, PTSF	89.4	%

Level of Service and Other Performance Measures

Level of service, LOS	E	
Volume to capacity ratio, v/c	0.70	
Peak 15-min vehicle-miles of travel, VMT15	0	veh-mi
Peak-hour vehicle-miles of travel, VMT60	0	veh-mi
Peak 15-min total travel time, TT15	0.0	veh-h

Notes:
1. If vp >= 3200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split vp >= 1700 pc/h, terminate analysis-the LOS is F.

HCS+: Two-Lane Highways Release 5.4

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Two-Way Two-Lane Highway Segment Analysis

Analyst	RSO
Agency/Co.	Traffic Management Consultant
Date Performed	10/29/2011
Analysis Time Period	Sat Peak Hr W/Conservation Alt
Highway	Kamehameha Highway
From/To	Hygienic Store
Jurisdiction	
Analysis Year	2025
Description	Turtle Bay Resort Master Plan

Input Data

Highway class	Class 1				
Shoulder width	6.0	ft	Peak-hour factor, PHF	0.94	
Lane width	12.0	ft	% Trucks and buses	3	%
Segment length	0.0	mi	% Recreational vehicles	0	%
Terrain type	Level		% No-passing zones	80	%
Grade: Length		mi	Access points/mi	10	/mi
Up/down		%			

Two-way hourly volume, V	2107	veh/h	
Directional split	54 / 46	%	

Average Travel Speed

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.1	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor,	0.997	
Two-way flow rate,(note-1) vp	2248	pc/h
Highest directional split proportion (note-2)	1214	pc/h
Free-Flow Speed from Field Measurement:		
Field measured speed, SFM	-	mi/h
Observed volume, Vf	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed, BFFS	45.0	mi/h
Adj. for lane and shoulder width, fLS	0.0	mi/h
Adj. for access points, fA	2.5	mi/h
Free-flow speed, FFS	42.5	mi/h
Adjustment for no-passing zones, fnp	0.9	mi/h

Average travel speed, ATS 24.2 mi/h

Percent Time-Spent-Following

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.0	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor, fHV	1.000	
Two-way flow rate,(note-1) vp	2241	pc/h
Highest directional split proportion (note-2)	1210	
Base percent time-spent-following, BPTSF	86.1	%
Adj.for directional distribution and no-passing zones, fd/np	3.3	
Percent time-spent-following, PTSF	89.4	%

Level of Service and Other Performance Measures

Level of service, LOS	E	
Volume to capacity ratio, v/c	0.70	
Peak 15-min vehicle-miles of travel, VMT15	0	veh-mi
Peak-hour vehicle-miles of travel, VMT60	0	veh-mi
Peak 15-min total travel time, TT15	0.0	veh-h

Notes:
1. If vp >= 3200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split vp >= 1700 pc/h, terminate analysis-the LOS is F.

TRAFFIC IMPACT ANALYSIS REPORT

FOR THE PROPOSED

TURTLE BAY RESORT MASTER PLAN

KAHUKU, OAHU, HAWAII

APPENDIX G

CAPACITY ANALYSIS WORKSHEETS

2025 TRAFFIC CONDITIONS WITH PROPOSED ACTION

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	196	405	413	68	69	185
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)	300			400	0	200
Storage Lanes	1			1	1	1
Taper Length (ft)	100				100	
Satd. Flow (prot)	1736	1681	1792	1509	1703	1509
Flt Permitted	0.950				0.950	
Satd. Flow (perm)	1736	1681	1792	1509	1703	1509
Right Turn on Red				Yes		Yes
Satd. Flow (RTOR)				95		201
Link Speed (mph)		45	45		30	
Link Distance (ft)		500	3000		500	
Travel Time (s)		7.6	45.5		11.4	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	4%	13%	6%	7%	6%	7%
Shared Lane Traffic (%)						
Lane Group Flow (vph)	213	440	449	74	75	201
Turn Type	Prot	NA	NA	Perm	NA	Perm
Protected Phases	7	4	8		6	
Permitted Phases				8		6
Detector Phase	7	4	8	8	6	6
Switch Phase						
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	10.0	22.0	22.0	22.0	22.0	22.0
Total Split (s)	24.0	58.0	34.0	34.0	22.0	22.0
Total Split (%)	30.0%	72.5%	42.5%	42.5%	27.5%	27.5%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead		Lag	Lag		
Lead-Lag Optimize?						
Recall Mode	None	None	None	None	Max	Max
Act Effct Green (s)	13.4	39.9	21.4	21.4	17.4	17.4
Actuated g/C Ratio	0.20	0.59	0.32	0.32	0.26	0.26
v/c Ratio	0.62	0.44	0.79	0.14	0.17	0.37
Control Delay	34.2	8.7	32.4	3.4	24.6	6.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	34.2	8.7	32.4	3.4	24.6	6.7
LOS	C	A	C	A	C	A
Approach Delay		17.0	28.3		11.5	
Approach LOS		B	C		B	
Queue Length 50th (ft)	81	87	165	0	24	0
Queue Length 95th (ft)	160	138	293	19	67	52
Internal Link Dist (ft)		420	2920		420	
Turn Bay Length (ft)	300			400		200
Base Capacity (vph)	499	1349	787	716	438	537
Starvation Cap Reductn	0	0	0	0	0	0

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.43	0.33	0.57	0.10	0.17	0.37

Intersection Summary	
Area Type: Other	
Cycle Length: 80	
Actuated Cycle Length: 67.5	
Natural Cycle: 60	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 0.79	
Intersection Signal Delay: 20.1	Intersection LOS: C
Intersection Capacity Utilization 48.9%	ICU Level of Service A
Analysis Period (min) 15	

Splits and Phases: 3: Kamehameha Hwy & Kaihalulu Dr

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	118	357	364	144	182	117
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)	200			400	0	0
Storage Lanes	1			1	1	1
Taper Length (ft)	100				100	
Satd. Flow (prot)	1736	1681	1792	1509	1703	1509
Flt Permitted	0.950				0.950	
Satd. Flow (perm)	1734	1681	1792	1478	1680	1490
Right Turn on Red				Yes		Yes
Satd. Flow (RTOR)				157		127
Link Speed (mph)		45	45		25	
Link Distance (ft)		500	5500		500	
Travel Time (s)		7.6	83.3		13.6	
Confl. Peds. (#/hr)	1			1	7	
Confl. Bikes (#/hr)				12		1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	4%	13%	6%	7%	6%	7%
Shared Lane Traffic (%)						
Lane Group Flow (vph)	128	388	396	157	198	127
Turn Type	Prot	NA	NA	Perm	NA	Perm
Protected Phases	7	4	8		6	
Permitted Phases				8		6
Detector Phase	7	4	8	8	6	6
Switch Phase						
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	9.0	21.0	21.0	21.0	21.0	21.0
Total Split (s)	13.0	38.0	25.0	25.0	22.0	22.0
Total Split (%)	21.7%	63.3%	41.7%	41.7%	36.7%	36.7%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead		Lag	Lag		
Lead-Lag Optimize?						
Recall Mode	None	None	None	None	Min	Min
Act Effct Green (s)	8.0	24.6	15.3	15.3	11.4	11.4
Actuated g/C Ratio	0.17	0.52	0.32	0.32	0.24	0.24
v/c Ratio	0.44	0.44	0.68	0.27	0.48	0.28
Control Delay	27.7	8.6	22.2	4.4	21.9	5.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	27.7	8.6	22.2	4.4	21.9	5.9
LOS	C	A	C	A	C	A
Approach Delay		13.4	17.1		15.6	
Approach LOS		B	B		B	
Queue Length 50th (ft)	35	53	99	0	51	0
Queue Length 95th (ft)	#101	128	205	33	109	33
Internal Link Dist (ft)		420	5420		420	
Turn Bay Length (ft)	200			400		

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Base Capacity (vph)	327	1188	845	780	683	673
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.39	0.33	0.47	0.20	0.29	0.19

Intersection Summary

Area Type: Other
Cycle Length: 60
Actuated Cycle Length: 47.1
Natural Cycle: 60
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.68
Intersection Signal Delay: 15.4 Intersection LOS: B
Intersection Capacity Utilization 48.3% ICU Level of Service A
Analysis Period (min) 15
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 5: Kamehameha Hwy & Kuilima Dr

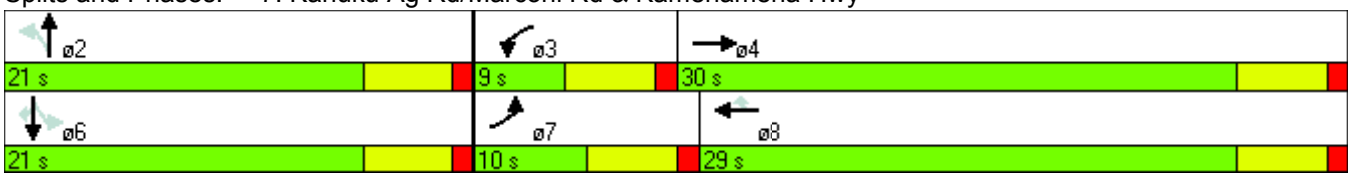
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	69	453	17	19	415	58	24	0	18	63	0	70
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	200		0	330		400	0		0	200		200
Storage Lanes	1		0	1		1	0		0	0		1
Taper Length (ft)	100			100			100			100		
Satd. Flow (prot)	1805	1654	0	1203	1792	1615	0	1160	0	0	1805	1615
Flt Permitted	0.950			0.950				0.795			0.727	
Satd. Flow (perm)	1805	1654	0	1203	1792	1568	0	948	0	0	1381	1615
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		4				127		127				127
Link Speed (mph)		45			45			30			25	
Link Distance (ft)		500			1200			500			500	
Travel Time (s)		7.6			18.2			11.4			13.6	
Confl. Bikes (#/hr)						10						
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	0%	13%	50%	50%	6%	0%	50%	2%	50%	0%	2%	0%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	75	510	0	21	451	63	0	46	0	0	68	76
Turn Type	Prot	NA		Prot	NA	Perm	Perm	NA		Perm	NA	Perm
Protected Phases	7	4		3	8			2			6	
Permitted Phases						8	2			6		6
Detector Phase	7	4		3	8	8	2	2		6	6	6
Switch Phase												
Minimum Initial (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Minimum Split (s)	9.0	21.0		9.0	21.0	21.0	21.0	21.0		21.0	21.0	21.0
Total Split (s)	10.0	30.0		9.0	29.0	29.0	21.0	21.0		21.0	21.0	21.0
Total Split (%)	16.7%	50.0%		15.0%	48.3%	48.3%	35.0%	35.0%		35.0%	35.0%	35.0%
Yellow Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
All-Red Time (s)	1.0	1.0		1.0	1.0	1.0	1.0	1.0		1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0		0.0	0.0	0.0		0.0			0.0	0.0
Total Lost Time (s)	5.0	5.0		5.0	5.0	5.0		5.0			5.0	5.0
Lead/Lag	Lead	Lag		Lead	Lag	Lag						
Lead-Lag Optimize?												
Recall Mode	None	None		None	None	None	Min	Min		Min	Min	Min
Act Effct Green (s)	5.5	19.7		4.4	16.1	16.1		8.0			8.0	8.0
Actuated g/C Ratio	0.14	0.49		0.11	0.40	0.40		0.20			0.20	0.20
v/c Ratio	0.30	0.62		0.16	0.63	0.09		0.16			0.25	0.18
Control Delay	24.3	11.9		25.2	15.2	0.7		1.2			19.4	2.7
Queue Delay	0.0	0.0		0.0	0.0	0.0		0.0			0.0	0.0
Total Delay	24.3	11.9		25.2	15.2	0.7		1.2			19.4	2.7
LOS	C	B		C	B	A		A			B	A
Approach Delay		13.5			13.9			1.2			10.6	
Approach LOS		B			B			A			B	
Queue Length 50th (ft)	18	59		5	90	0		0			15	0
Queue Length 95th (ft)	#61	217		25	182	4		0			48	13
Internal Link Dist (ft)		420			1120			420			420	
Turn Bay Length (ft)	200			330		400						200
Base Capacity (vph)	247	1166		131	1177	1073		486			605	778

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Starvation Cap Reductn	0	0		0	0	0		0			0	0
Spillback Cap Reductn	0	0		0	0	0		0			0	0
Storage Cap Reductn	0	0		0	0	0		0			0	0
Reduced v/c Ratio	0.30	0.44		0.16	0.38	0.06		0.09			0.11	0.10

Intersection Summary

Area Type: Other
Cycle Length: 60
Actuated Cycle Length: 40
Natural Cycle: 60
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.63
Intersection Signal Delay: 12.9 Intersection LOS: B
Intersection Capacity Utilization 49.8% ICU Level of Service A
Analysis Period (min) 15
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 7: Kahuku Ag Rd/Marconi Rd & Kamehameha Hwy



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	344	27	44	361	316	423
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0	0	0			450
Storage Lanes	1	1	1			1
Taper Length (ft)	100		100			
Satd. Flow (prot)	1719	1615	1805	1792	1845	1568
Flt Permitted	0.950		0.950			
Satd. Flow (perm)	1719	1615	1805	1792	1845	1568
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)		127				450
Link Speed (mph)	30			30	30	
Link Distance (ft)	220			382	754	
Travel Time (s)	5.0			8.7	17.1	
Peak Hour Factor	0.88	1.00	0.61	0.97	1.00	0.94
Heavy Vehicles (%)	5%	0%	0%	6%	3%	3%
Shared Lane Traffic (%)						
Lane Group Flow (vph)	391	27	72	372	316	450
Turn Type	NA	Perm	Prot	NA	NA	Perm
Protected Phases	3		1	6	2	
Permitted Phases		3				2
Detector Phase	3	3	1	6	2	2
Switch Phase						
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	21.0	21.0	9.0	9.0	21.0	21.0
Total Split (s)	26.0	26.0	9.0	34.0	25.0	25.0
Total Split (%)	43.3%	43.3%	15.0%	56.7%	41.7%	41.7%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag			Lead		Lag	Lag
Lead-Lag Optimize?						
Recall Mode	None	None	None	None	Max	Max
Act Effct Green (s)	16.6	16.6	4.1	25.9	21.0	21.0
Actuated g/C Ratio	0.31	0.31	0.08	0.49	0.40	0.40
v/c Ratio	0.72	0.05	0.51	0.42	0.43	0.50
Control Delay	25.0	0.1	42.7	11.2	16.4	4.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	25.0	0.1	42.7	11.2	16.4	4.2
LOS	C	A	D	B	B	A
Approach Delay	23.4			16.3	9.2	
Approach LOS	C			B	A	
Queue Length 50th (ft)	116	0	24	71	81	0
Queue Length 95th (ft)	194	0	41	140	157	54
Internal Link Dist (ft)	140			302	674	
Turn Bay Length (ft)						450
Base Capacity (vph)	701	734	140	1009	736	896
Starvation Cap Reductn	0	0	0	0	0	0

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.56	0.04	0.51	0.37	0.43	0.50

Intersection Summary	
Area Type: Other	
Cycle Length: 60	
Actuated Cycle Length: 52.7	
Natural Cycle: 55	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 0.72	
Intersection Signal Delay: 14.8	Intersection LOS: B
Intersection Capacity Utilization 51.5%	ICU Level of Service A
Analysis Period (min) 15	

Splits and Phases: 3: J. P. Leong Hwy/Kamehameha Hwy

Intersection	
Intersection Delay (sec/veh):	$ 608.6

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Volume (vph)	42	103	393	152	513	458
Conflicting Peds.(#/hr)	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
Right Turn Channelized	Yield	Yield	Yield	Yield	None	None
Storage Length	0	0		200	0	
Median Width	12		0			0
Grade (%)	0%		0%			0%
Peak Hour Factor	0.75	0.83	0.96	0.83	0.77	1.00
Heavy Vehicles(%)	6	7	5	4	2	3
Movement Flow Rate	56	124	409	183	666	458
Number of Lanes	1	0	1	1	0	1

Major/Minor			Major 1			Major 2
Conflicting Flow Rate - All	2291	297	0	0	592	0
Stage 1	501	-	-	-	-	-
Stage 2	1790	-	-	-	-	-
Follow-up Headway	3.554	3.363	-	-	2.218	-
Pot Capacity-1 Maneuver	# 42	731	-	-	984	-
Stage 1	601	-	-	-	-	-
Stage 2	143	-	-	-	-	-
Time blocked-Platoon(%)	0	0	-	-	0	-
Mov Capacity-1 Maneuver	# 4	731	-	-	984	-
Mov Capacity-2 Maneuver	# 4	-	-	-	-	-
Stage 1	601	-	-	-	-	-
Stage 2	# 13	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay (s)	$ 6350.5	0	9.5
HCM LOS	F	A	A

Lane	NBT	NBR	WBLn1	SBL	SBT
Capacity (vph)			13		
HCM Control Delay (s)	-	-	$ 6350.5	15.962	-
HCM Lane VC Ratio	-	-	13.854	0.677	-
HCM Lane LOS	-	-	F	C	-
HCM 95th Percentile Queue (veh)	-	-	23.733	5.522	-

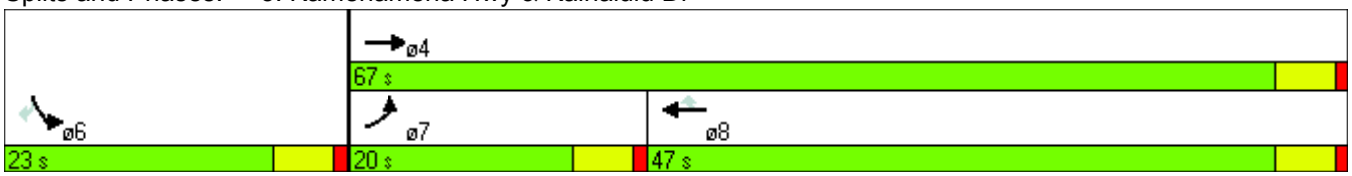
Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	173	541	573	51	39	186
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)	300			400	0	200
Storage Lanes	1			1	1	1
Taper Length (ft)	100				100	
Satd. Flow (prot)	1770	1845	1810	1495	1736	1509
Flt Permitted	0.950				0.950	
Satd. Flow (perm)	1770	1845	1810	1495	1736	1509
Right Turn on Red				Yes		Yes
Satd. Flow (RTOR)				85		202
Link Speed (mph)		45	45		30	
Link Distance (ft)		500	3000		500	
Travel Time (s)		7.6	45.5		11.4	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	2%	3%	5%	8%	4%	7%
Shared Lane Traffic (%)						
Lane Group Flow (vph)	188	588	623	55	42	202
Turn Type	Prot	NA	NA	Perm	NA	Perm
Protected Phases	7	4	8		6	
Permitted Phases				8		6
Detector Phase	7	4	8	8	6	6
Switch Phase						
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	10.0	22.0	22.0	22.0	22.0	22.0
Total Split (s)	20.0	67.0	47.0	47.0	23.0	23.0
Total Split (%)	22.2%	74.4%	52.2%	52.2%	25.6%	25.6%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead		Lag	Lag		
Lead-Lag Optimize?						
Recall Mode	None	None	None	None	Max	Max
Act Effct Green (s)	12.4	49.0	31.4	31.4	18.4	18.4
Actuated g/C Ratio	0.16	0.63	0.40	0.40	0.24	0.24
v/c Ratio	0.66	0.51	0.85	0.08	0.10	0.39
Control Delay	44.8	9.0	32.9	1.7	28.4	7.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	44.8	9.0	32.9	1.7	28.4	7.4
LOS	D	A	C	A	C	A
Approach Delay		17.7	30.4		11.0	
Approach LOS		B	C		B	
Queue Length 50th (ft)	87	132	268	0	17	0
Queue Length 95th (ft)	#174	196	414	10	48	56
Internal Link Dist (ft)		420	2920		420	
Turn Bay Length (ft)	300			400		200
Base Capacity (vph)	350	1495	1001	865	411	512
Starvation Cap Reductn	0	0	0	0	0	0

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.54	0.39	0.62	0.06	0.10	0.39

Intersection Summary

Area Type: Other
Cycle Length: 90
Actuated Cycle Length: 77.6
Natural Cycle: 65
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.85
Intersection Signal Delay: 21.8 Intersection LOS: C
Intersection Capacity Utilization 55.6% ICU Level of Service B
Analysis Period (min) 15
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 3: Kamehameha Hwy & Kaihalulu Dr



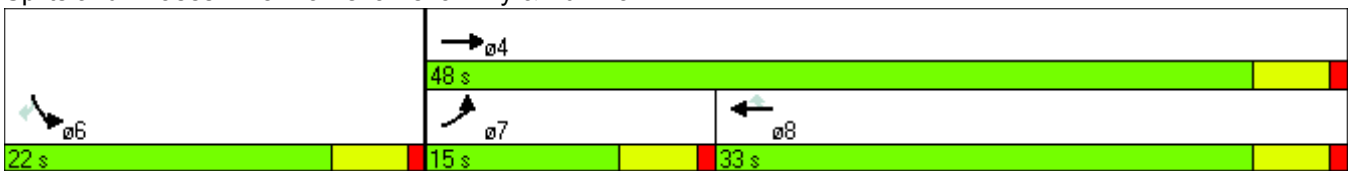
Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	144	437	478	238	188	146
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)	200			400	0	0
Storage Lanes	1			1	1	1
Taper Length (ft)	100				100	
Satd. Flow (prot)	1741	1815	1781	1471	1715	1503
Flt Permitted	0.950				0.950	
Satd. Flow (perm)	1741	1815	1781	1444	1703	1482
Right Turn on Red				Yes		Yes
Satd. Flow (RTOR)				259		159
Link Speed (mph)		45	45		25	
Link Distance (ft)		500	5500		500	
Travel Time (s)		7.6	83.3		13.6	
Confl. Peds. (#/hr)					3	1
Confl. Bikes (#/hr)				12		1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	2%	3%	5%	8%	4%	7%
Bus Blockages (#/hr)	4	4	4	4	3	1
Shared Lane Traffic (%)						
Lane Group Flow (vph)	157	475	520	259	204	159
Turn Type	Prot	NA	NA	Perm	NA	Perm
Protected Phases	7	4	8		6	
Permitted Phases				8		6
Detector Phase	7	4	8	8	6	6
Switch Phase						
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	9.0	21.0	21.0	21.0	21.0	21.0
Total Split (s)	15.0	48.0	33.0	33.0	22.0	22.0
Total Split (%)	21.4%	68.6%	47.1%	47.1%	31.4%	31.4%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead		Lag	Lag		
Lead-Lag Optimize?						
Recall Mode	None	None	None	None	Min	Min
Act Effct Green (s)	9.6	32.7	22.0	22.0	12.5	12.5
Actuated g/C Ratio	0.17	0.58	0.39	0.39	0.22	0.22
v/c Ratio	0.53	0.45	0.74	0.36	0.54	0.35
Control Delay	34.0	7.9	24.1	3.7	28.0	6.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	34.0	7.9	24.1	3.7	28.0	6.9
LOS	C	A	C	A	C	A
Approach Delay		14.4	17.4		18.7	
Approach LOS		B	B		B	
Queue Length 50th (ft)	54	74	162	0	68	0
Queue Length 95th (ft)	#138	151	296	40	136	42
Internal Link Dist (ft)		420	5420		420	

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Turn Bay Length (ft)	200			400		
Base Capacity (vph)	341	1370	979	910	572	600
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.46	0.35	0.53	0.28	0.36	0.27

Intersection Summary

Area Type: Other
Cycle Length: 70
Actuated Cycle Length: 56.2
Natural Cycle: 60
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.74
Intersection Signal Delay: 16.6 Intersection LOS: B
Intersection Capacity Utilization 56.1% ICU Level of Service B
Analysis Period (min) 15
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 5: Kamehameha Hwy & Kuilima Dr



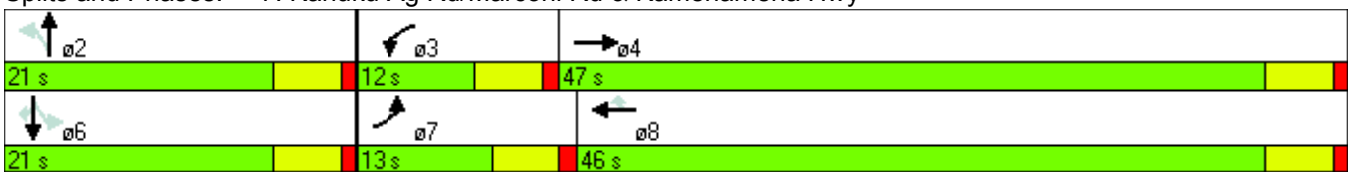
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	78	523	24	28	610	69	24	0	20	70	0	82
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	200		0	330		400	0		0	200		200
Storage Lanes	1		0	1		1	0		0	0		1
Taper Length (ft)	100			100			100			100		
Satd. Flow (prot)	1805	1796	0	1203	1810	1615	0	1157	0	0	1805	1615
Flt Permitted	0.950			0.950				0.805			0.726	
Satd. Flow (perm)	1805	1796	0	1203	1810	1571	0	956	0	0	1379	1615
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		4				95		95				95
Link Speed (mph)		45			45			30			25	
Link Distance (ft)		500			1200			500			500	
Travel Time (s)		7.6			18.2			11.4			13.6	
Confl. Bikes (#/hr)						10						
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	0%	3%	50%	50%	5%	0%	50%	2%	50%	0%	2%	0%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	85	594	0	30	663	75	0	48	0	0	76	89
Turn Type	Prot	NA		Prot	NA	Perm	Perm	NA		Perm	NA	Perm
Protected Phases	7	4		3	8			2			6	
Permitted Phases						8	2			6		6
Detector Phase	7	4		3	8	8	2	2		6	6	6
Switch Phase												
Minimum Initial (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Minimum Split (s)	9.0	21.0		9.0	21.0	21.0	21.0	21.0		21.0	21.0	21.0
Total Split (s)	13.0	47.0		12.0	46.0	46.0	21.0	21.0		21.0	21.0	21.0
Total Split (%)	16.3%	58.8%		15.0%	57.5%	57.5%	26.3%	26.3%		26.3%	26.3%	26.3%
Yellow Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
All-Red Time (s)	1.0	1.0		1.0	1.0	1.0	1.0	1.0		1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0		0.0	0.0	0.0		0.0			0.0	0.0
Total Lost Time (s)	5.0	5.0		5.0	5.0	5.0		5.0			5.0	5.0
Lead/Lag	Lead	Lag		Lead	Lag	Lag						
Lead-Lag Optimize?												
Recall Mode	None	None		None	None	None	Min	Min		Min	Min	Min
Act Effct Green (s)	7.9	31.3		7.1	25.8	25.8		9.3			9.3	9.3
Actuated g/C Ratio	0.14	0.56		0.13	0.46	0.46		0.17			0.17	0.17
v/c Ratio	0.33	0.59		0.20	0.79	0.10		0.20			0.33	0.26
Control Delay	31.7	11.9		32.5	21.3	1.9		3.3			29.7	8.4
Queue Delay	0.0	0.0		0.0	0.0	0.0		0.0			0.0	0.0
Total Delay	31.7	11.9		32.5	21.3	1.9		3.3			29.7	8.4
LOS	C	B		C	C	A		A			C	A
Approach Delay		14.4			19.8			3.3			18.2	
Approach LOS		B			B			A			B	
Queue Length 50th (ft)	27	78		10	187	0		0			24	0
Queue Length 95th (ft)	82	282		39	346	13		7			71	34
Internal Link Dist (ft)		420			1120			420			420	
Turn Bay Length (ft)	200			330		400						200
Base Capacity (vph)	296	1344		172	1330	1180		377			452	593

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Starvation Cap Reductn	0	0		0	0	0		0			0	0
Spillback Cap Reductn	0	0		0	0	0		0			0	0
Storage Cap Reductn	0	0		0	0	0		0			0	0
Reduced v/c Ratio	0.29	0.44		0.17	0.50	0.06		0.13			0.17	0.15

Intersection Summary

Area Type: Other
Cycle Length: 80
Actuated Cycle Length: 55.7
Natural Cycle: 60
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.79
Intersection Signal Delay: 16.9 Intersection LOS: B
Intersection Capacity Utilization 58.1% ICU Level of Service B
Analysis Period (min) 15

Splits and Phases: 7: Kahuku Ag Rd/Marconi Rd & Kamehameha Hwy



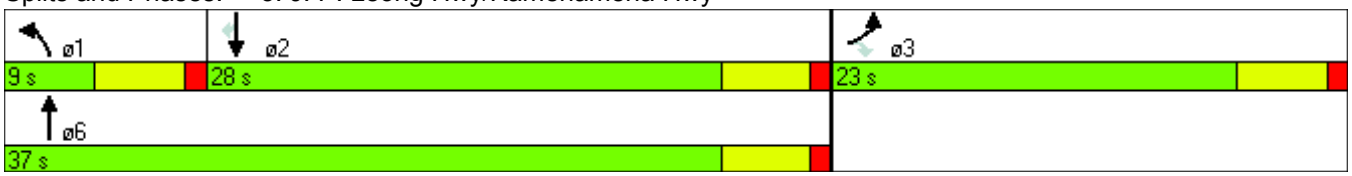
Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	429	18	43	516	468	506
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0	0	0			450
Storage Lanes	1	1	1			1
Taper Length (ft)	100		100			
Satd. Flow (prot)	1787	1615	1805	1900	1810	1583
Flt Permitted	0.950		0.950			
Satd. Flow (perm)	1787	1615	1805	1900	1810	1583
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)		127				511
Link Speed (mph)	30			30	30	
Link Distance (ft)	220			382	754	
Travel Time (s)	5.0			8.7	17.1	
Peak Hour Factor	0.98	1.00	1.00	1.00	0.87	0.99
Heavy Vehicles (%)	1%	0%	0%	0%	5%	2%
Shared Lane Traffic (%)						
Lane Group Flow (vph)	438	18	43	516	538	511
Turn Type	NA	Perm	Prot	NA	NA	Perm
Protected Phases	3		1	6	2	
Permitted Phases		3				2
Detector Phase	3	3	1	6	2	2
Switch Phase						
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	21.0	21.0	9.0	9.0	21.0	21.0
Total Split (s)	23.0	23.0	9.0	37.0	28.0	28.0
Total Split (%)	38.3%	38.3%	15.0%	61.7%	46.7%	46.7%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag			Lead		Lag	Lag
Lead-Lag Optimize?						
Recall Mode	None	None	None	None	Max	Max
Act Effct Green (s)	16.3	16.3	4.1	26.6	23.4	23.4
Actuated g/C Ratio	0.31	0.31	0.08	0.50	0.44	0.44
v/c Ratio	0.80	0.03	0.31	0.54	0.67	0.52
Control Delay	31.2	0.1	32.0	11.8	19.6	3.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	31.2	0.1	32.0	11.8	19.6	3.7
LOS	C	A	C	B	B	A
Approach Delay	30.0			13.4	11.8	
Approach LOS	C			B	B	
Queue Length 50th (ft)	109	0	13	108	117	0
Queue Length 95th (ft)	#286	0	42	180	#295	52
Internal Link Dist (ft)	140			302	674	
Turn Bay Length (ft)						450
Base Capacity (vph)	615	639	138	1163	798	983
Starvation Cap Reductn	0	0	0	0	0	0

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.71	0.03	0.31	0.44	0.67	0.52

Intersection Summary	
Area Type: Other	
Cycle Length: 60	
Actuated Cycle Length: 53	
Natural Cycle: 60	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 0.80	
Intersection Signal Delay: 16.3	Intersection LOS: B
Intersection Capacity Utilization 64.2%	ICU Level of Service C
Analysis Period (min) 15	

\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 3: J. P. Leong Hwy/Kamehameha Hwy



Intersection	
Intersection Delay (sec/veh):	5

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Volume (vph)	61	322	851	77	104	75
Conflicting Peds.(#/hr)	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
Right Turn Channelized	Yield	Yield	Yield	Yield	None	None
Storage Length	0	0		200	0	
Median Width	12		0			0
Grade (%)	0%		0%			0%
Peak Hour Factor	0.95	0.99	0.96	0.84	1.00	1.00
Heavy Vehicles(%)	6	5	3	5	3	2
Movement Flow Rate	64	325	886	92	104	75
Number of Lanes	1	0	1	1	0	1

Major/Minor			Major 1			Major 2
Conflicting Flow Rate - All	1215	489	0	0	978	0
Stage 1	932	-	-	-	-	-
Stage 2	283	-	-	-	-	-
Follow-up Headway	3.554	3.345	-	-	2.227	-
Pot Capacity-1 Maneuver	197	573	-	-	702	-
Stage 1	377	-	-	-	-	-
Stage 2	756	-	-	-	-	-
Time blocked-Platoon(%)	0	0	-	-	0	-
Mov Capacity-1 Maneuver	166	573	-	-	702	-
Mov Capacity-2 Maneuver	166	-	-	-	-	-
Stage 1	377	-	-	-	-	-
Stage 2	639	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay (s)	16.9	0	6.4
HCM LOS	C	A	A

Lane	NBT	NBR	WBLn1	SBL	SBT
Capacity (vph)			686		
HCM Control Delay (s)	-	-	16.9	11.018	-
HCM Lane VC Ratio	-	-	0.568	0.148	-
HCM Lane LOS	-	-	C	B	-
HCM 95th Percentile Queue (veh)	-	-	3.592	0.518	-

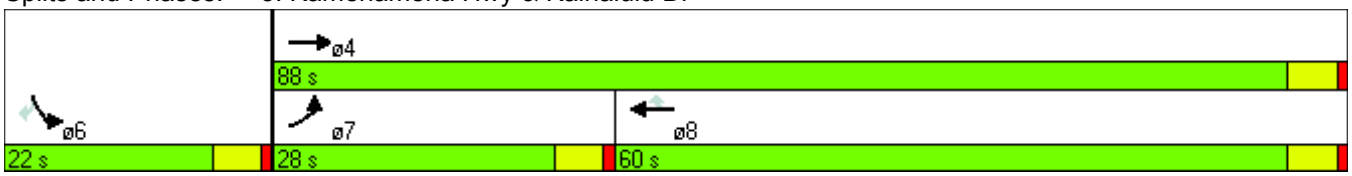
Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	234	667	694	64	81	247
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)	300			400	0	200
Storage Lanes	1			1	1	1
Taper Length (ft)	100				100	
Satd. Flow (prot)	1752	1863	1810	1553	1752	1583
Flt Permitted	0.950				0.950	
Satd. Flow (perm)	1752	1863	1810	1553	1752	1583
Right Turn on Red				Yes		Yes
Satd. Flow (RTOR)				70		268
Link Speed (mph)		45	45		30	
Link Distance (ft)		500	3000		500	
Travel Time (s)		7.6	45.5		11.4	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	3%	2%	5%	4%	3%	2%
Shared Lane Traffic (%)						
Lane Group Flow (vph)	254	725	754	70	88	268
Turn Type	Prot	NA	NA	Perm	NA	Perm
Protected Phases	7	4	8		6	
Permitted Phases				8		6
Detector Phase	7	4	8	8	6	6
Switch Phase						
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	10.0	22.0	22.0	22.0	22.0	22.0
Total Split (s)	28.0	88.0	60.0	60.0	22.0	22.0
Total Split (%)	25.5%	80.0%	54.5%	54.5%	20.0%	20.0%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead		Lag	Lag		
Lead-Lag Optimize?						
Recall Mode	None	None	None	None	Max	Max
Act Effct Green (s)	18.3	67.9	44.5	44.5	17.5	17.5
Actuated g/C Ratio	0.19	0.71	0.47	0.47	0.18	0.18
v/c Ratio	0.76	0.55	0.90	0.09	0.28	0.53
Control Delay	53.7	7.9	38.2	3.9	41.4	9.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	53.7	7.9	38.2	3.9	41.4	9.4
LOS	D	A	D	A	D	A
Approach Delay		19.8	35.3		17.3	
Approach LOS		B	D		B	
Queue Length 50th (ft)	153	174	411	0	50	0
Queue Length 95th (ft)	259	244	#633	23	105	74
Internal Link Dist (ft)		420	2920		420	
Turn Bay Length (ft)	300			400		200
Base Capacity (vph)	433	1603	1070	946	319	508
Starvation Cap Reductn	0	0	0	0	0	0

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.59	0.45	0.70	0.07	0.28	0.53

Intersection Summary

Area Type: Other
Cycle Length: 110
Actuated Cycle Length: 95.6
Natural Cycle: 80
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.90
Intersection Signal Delay: 25.3 Intersection LOS: C
Intersection Capacity Utilization 66.5% ICU Level of Service C
Analysis Period (min) 15
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 3: Kamehameha Hwy & Kaihalulu Dr



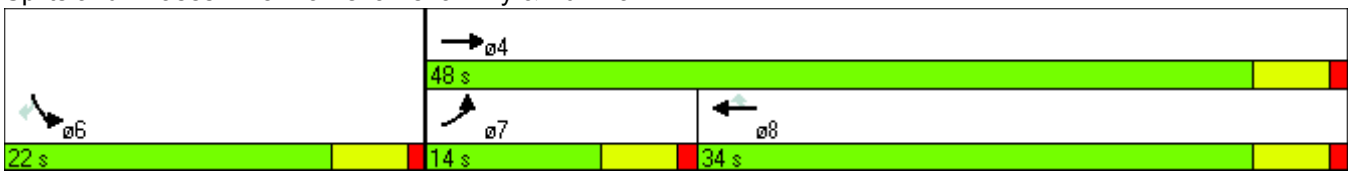
Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	164	584	585	224	227	173
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)	200			400	0	0
Storage Lanes	1			1	1	1
Taper Length (ft)	100				100	
Satd. Flow (prot)	1738	1848	1795	1540	1738	1571
Flt Permitted	0.950				0.950	
Satd. Flow (perm)	1738	1848	1795	1512	1738	1550
Right Turn on Red				Yes		Yes
Satd. Flow (RTOR)				243		188
Link Speed (mph)		45	45		25	
Link Distance (ft)		500	5500		500	
Travel Time (s)		7.6	83.3		13.6	
Confl. Bikes (#/hr)				12		1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	3%	2%	5%	4%	3%	2%
Bus Blockages (#/hr)	2	2	2	2	2	2
Shared Lane Traffic (%)						
Lane Group Flow (vph)	178	635	636	243	247	188
Turn Type	Prot	NA	NA	Perm	NA	Perm
Protected Phases	7	4	8		6	
Permitted Phases				8		6
Detector Phase	7	4	8	8	6	6
Switch Phase						
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	9.0	21.0	21.0	21.0	21.0	21.0
Total Split (s)	14.0	48.0	34.0	34.0	22.0	22.0
Total Split (%)	20.0%	68.6%	48.6%	48.6%	31.4%	31.4%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead		Lag	Lag		
Lead-Lag Optimize?						
Recall Mode	None	None	None	None	Min	Min
Act Effct Green (s)	8.9	39.8	25.8	25.8	13.6	13.6
Actuated g/C Ratio	0.14	0.63	0.41	0.41	0.21	0.21
v/c Ratio	0.73	0.55	0.87	0.32	0.67	0.39
Control Delay	48.9	9.4	33.3	3.4	33.1	6.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	48.9	9.4	33.3	3.4	33.1	6.7
LOS	D	A	C	A	C	A
Approach Delay		18.1	25.1		21.7	
Approach LOS		B	C		C	
Queue Length 50th (ft)	72	125	223	0	94	0
Queue Length 95th (ft)	#175	225	#430	38	164	45
Internal Link Dist (ft)		420	5420		420	
Turn Bay Length (ft)	200			400		

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Base Capacity (vph)	250	1273	834	832	473	558
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.71	0.50	0.76	0.29	0.52	0.34

Intersection Summary	
Area Type: Other	
Cycle Length: 70	
Actuated Cycle Length: 63.6	
Natural Cycle: 65	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 0.87	
Intersection Signal Delay: 21.7	Intersection LOS: C
Intersection Capacity Utilization 65.0%	ICU Level of Service C
Analysis Period (min) 15	

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 5: Kamehameha Hwy & Kuilima Dr



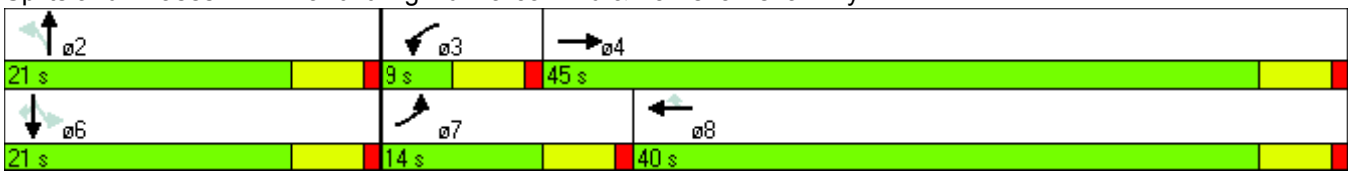
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	152	641	18	18	655	127	16	0	16	100	0	138
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	200		0	330		400	0		0	200		200
Storage Lanes	1		0	1		1	0		0	0		1
Taper Length (ft)	100			100			100			100		
Satd. Flow (prot)	1805	1817	0	1203	1812	1615	0	1152	0	0	1805	1615
Flt Permitted	0.950			0.950				0.825			0.735	
Satd. Flow (perm)	1805	1817	0	1203	1812	1570	0	974	0	0	1396	1615
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		3				138		102				150
Link Speed (mph)		45			45			30			25	
Link Distance (ft)		500			1200			500			500	
Travel Time (s)		7.6			18.2			11.4			13.6	
Confl. Bikes (#/hr)						10						
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	0%	2%	50%	50%	4%	0%	50%	2%	50%	0%	2%	0%
Bus Blockages (#/hr)	0	2	0	0	2	0	0	0	0	0	0	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	165	717	0	20	712	138	0	34	0	0	109	150
Turn Type	Prot	NA		Prot	NA	Perm	Perm	NA		Perm	NA	Perm
Protected Phases	7	4		3	8			2			6	
Permitted Phases						8	2			6		6
Detector Phase	7	4		3	8	8	2	2		6	6	6
Switch Phase												
Minimum Initial (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Minimum Split (s)	9.0	21.0		9.0	21.0	21.0	21.0	21.0		21.0	21.0	21.0
Total Split (s)	14.0	45.0		9.0	40.0	40.0	21.0	21.0		21.0	21.0	21.0
Total Split (%)	18.7%	60.0%		12.0%	53.3%	53.3%	28.0%	28.0%		28.0%	28.0%	28.0%
Yellow Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
All-Red Time (s)	1.0	1.0		1.0	1.0	1.0	1.0	1.0		1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0		0.0	0.0	0.0		0.0			0.0	0.0
Total Lost Time (s)	5.0	5.0		5.0	5.0	5.0		5.0			5.0	5.0
Lead/Lag	Lead	Lag		Lead	Lag	Lag						
Lead-Lag Optimize?												
Recall Mode	None	None		None	None	None	Min	Min		Min	Min	Min
Act Effct Green (s)	8.9	41.6		4.1	29.1	29.1		10.5			10.5	10.5
Actuated g/C Ratio	0.14	0.65		0.06	0.46	0.46		0.16			0.16	0.16
v/c Ratio	0.66	0.61		0.26	0.87	0.17		0.14			0.48	0.38
Control Delay	44.4	10.7		41.6	29.0	2.9		1.2			33.1	8.3
Queue Delay	0.0	0.0		0.0	0.0	0.0		0.0			0.0	0.0
Total Delay	44.4	10.7		41.6	29.0	2.9		1.2			33.1	8.3
LOS	D	B		D	C	A		A			C	A
Approach Delay		17.0			25.1			1.2			18.7	
Approach LOS		B			C			A			B	
Queue Length 50th (ft)	66	121		8	234	0		0			41	0
Queue Length 95th (ft)	#169	375		31	#485	27		0			89	44
Internal Link Dist (ft)		420			1120			420			420	
Turn Bay Length (ft)	200			330		400						200

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Base Capacity (vph)	261	1253		77	1021	945		326			359	527
Starvation Cap Reductn	0	0		0	0	0		0			0	0
Spillback Cap Reductn	0	0		0	0	0		0			0	0
Storage Cap Reductn	0	0		0	0	0		0			0	0
Reduced v/c Ratio	0.63	0.57		0.26	0.70	0.15		0.10			0.30	0.28

Intersection Summary

Area Type: Other
Cycle Length: 75
Actuated Cycle Length: 63.9
Natural Cycle: 70
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.87
Intersection Signal Delay: 20.4 Intersection LOS: C
Intersection Capacity Utilization 65.2% ICU Level of Service C
Analysis Period (min) 15
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 7: Kahuku Ag Rd/Marconi Rd & Kamehameha Hwy



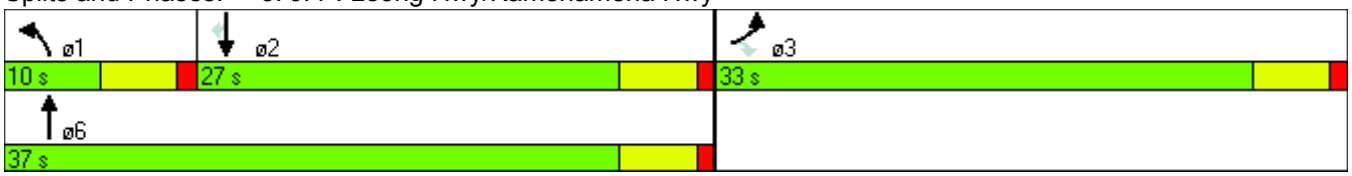
Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	473	41	76	609	490	559
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0	0	0			450
Storage Lanes	1	1	1			1
Taper Length (ft)	100		100			
Satd. Flow (prot)	1787	1615	1805	1845	1881	1583
Flt Permitted	0.950		0.950			
Satd. Flow (perm)	1787	1615	1805	1845	1881	1583
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)		109				643
Link Speed (mph)	30			30	30	
Link Distance (ft)	220			382	754	
Travel Time (s)	5.0			8.7	17.1	
Peak Hour Factor	0.83	0.68	1.00	1.00	0.95	0.87
Heavy Vehicles (%)	1%	0%	0%	3%	1%	2%
Shared Lane Traffic (%)						
Lane Group Flow (vph)	570	60	76	609	516	643
Turn Type	NA	Perm	Prot	NA	NA	Perm
Protected Phases	3		1	6	2	
Permitted Phases		3				2
Detector Phase	3	3	1	6	2	2
Switch Phase						
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	21.0	21.0	9.0	9.0	21.0	21.0
Total Split (s)	33.0	33.0	10.0	37.0	27.0	27.0
Total Split (%)	47.1%	47.1%	14.3%	52.9%	38.6%	38.6%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag			Lead		Lag	Lag
Lead-Lag Optimize?						
Recall Mode	None	None	None	None	Max	Max
Act Effct Green (s)	23.9	23.9	5.1	30.0	22.5	22.5
Actuated g/C Ratio	0.37	0.37	0.08	0.47	0.35	0.35
v/c Ratio	0.86	0.09	0.53	0.71	0.78	0.66
Control Delay	33.5	1.2	47.0	19.9	32.0	5.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	33.5	1.2	47.0	19.9	32.0	5.7
LOS	C	A	D	B	C	A
Approach Delay	30.4			22.9	17.4	
Approach LOS	C			C	B	
Queue Length 50th (ft)	209	0	32	199	204	0
Queue Length 95th (ft)	292	0	#89	321	#377	58
Internal Link Dist (ft)	140			302	674	
Turn Bay Length (ft)						450
Base Capacity (vph)	798	781	143	942	660	972
Starvation Cap Reductn	0	0	0	0	0	0

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.71	0.08	0.53	0.65	0.78	0.66

Intersection Summary

Area Type: Other
Cycle Length: 70
Actuated Cycle Length: 64.2
Natural Cycle: 60
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.86
Intersection Signal Delay: 22.2 Intersection LOS: C
Intersection Capacity Utilization 68.7% ICU Level of Service C
Analysis Period (min) 15
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 3: J. P. Leong Hwy/Kamehameha Hwy



Intersection	
Intersection Delay (sec/veh):	95.3

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Volume (vph)	56	301	866	92	96	876
Conflicting Peds.(#/hr)	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
Right Turn Channelized	Yield	Yield	Yield	Yield	None	None
Storage Length	0	0		200	0	
Median Width	12		0			0
Grade (%)	0%		0%			0%
Peak Hour Factor	1.00	1.00	0.91	0.79	0.79	0.93
Heavy Vehicles(%)	7	2	2	6	4	3
Movement Flow Rate	56	301	952	116	122	942
Number of Lanes	1	0	1	1	0	1

Major/Minor			Major 1			Major 2
Conflicting Flow Rate - All	2196	534	0	0	1068	0
Stage 1	1010	-	-	-	-	-
Stage 2	1186	-	-	-	-	-
Follow-up Headway	3.563	3.318	-	-	2.236	-
Pot Capacity-1 Maneuver	# 48	546	-	-	645	-
Stage 1	344	-	-	-	-	-
Stage 2	283	-	-	-	-	-
Time blocked-Platoon(%)	0	0	-	-	0	-
Mov Capacity-1 Maneuver	# 29	546	-	-	645	-
Mov Capacity-2 Maneuver	# 29	-	-	-	-	-
Stage 1	344	-	-	-	-	-
Stage 2	171	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay (s)	$ 660.2	0	1.4
HCM LOS	F	A	A

Lane	NBT	NBR	WBLn1	SBL	SBT
Capacity (vph)			154		
HCM Control Delay (s)	-	-	$ 660.2	11.872	-
HCM Lane VC Ratio	-	-	2.318	0.188	-
HCM Lane LOS	-	-	F	B	-
HCM 95th Percentile Queue (veh)	-	-	29.859	0.689	-

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Two-Way Two-Lane Highway Segment Analysis

Analyst	RSO
Agency/Co.	Traffic Management Consultant
Date Performed	11/3/11
Analysis Time Period	AM Peak Hour W/Proposed Action
Highway	Kamehameha Highway
From/To	West of Kaihalulu Drive
Jurisdiction	
Analysis Year	2025
Description	Turtle Bay Resort Master Plan

Input Data

Highway class	Class 1				
Shoulder width	6.0	ft	Peak-hour factor, PHF	0.92	
Lane width	12.0	ft	% Trucks and buses	8	%
Segment length	0.0	mi	% Recreational vehicles	0	%
Terrain type	Level		% No-passing zones	50	%
Grade: Length		mi	Access points/mi	2	/mi
Up/down		%			

Two-way hourly volume, V	1199	veh/h	
Directional split	50 / 50	%	

Average Travel Speed

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.1	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor,	0.992	
Two-way flow rate,(note-1) vp	1314	pc/h
Highest directional split proportion (note-2)	657	pc/h

Free-Flow Speed from Field Measurement:		
Field measured speed, SFM	-	mi/h
Observed volume, Vf	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed, BFFS	45.0	mi/h
Adj. for lane and shoulder width, fLS	0.0	mi/h
Adj. for access points, fA	0.5	mi/h
Free-flow speed, FFS	44.5	mi/h

Adjustment for no-passing zones, fnp	1.2	mi/h
Average travel speed, ATS	33.1	mi/h

Percent Time-Spent-Following

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.0	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor, fHV	1.000	
Two-way flow rate,(note-1) vp	1303	pc/h
Highest directional split proportion (note-2)	652	
Base percent time-spent-following, BPTSF	68.2	%
Adj.for directional distribution and no-passing zones, fd/np	7.2	
Percent time-spent-following, PTSF	75.4	%

Level of Service and Other Performance Measures

Level of service, LOS	E	
Volume to capacity ratio, v/c	0.41	
Peak 15-min vehicle-miles of travel, VMT15	0	veh-mi
Peak-hour vehicle-miles of travel, VMT60	0	veh-mi
Peak 15-min total travel time, TT15	0.0	veh-h

Notes:
1. If vp >= 3200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split vp >= 1700 pc/h, terminate analysis-the LOS is F.

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Two-Way Two-Lane Highway Segment Analysis

Analyst	RSO
Agency/Co.	Traffic Management Consultant
Date Performed	11/1/2011
Analysis Time Period	AM Peak Hour W/Proposed Action
Highway	Kamehameha Highway
From/To	Haleiwa to Kawailoa
Jurisdiction	
Analysis Year	2025
Description	Turtle Bay Resort Master Plan

Input Data

Highway class	Class 1				
Shoulder width	6.0	ft	Peak-hour factor, PHF	0.95	
Lane width	12.0	ft	% Trucks and buses	5	%
Segment length	0.0	mi	% Recreational vehicles	0	%
Terrain type	Level		% No-passing zones	80	%
Grade: Length		mi	Access points/mi	2	/mi
Up/down		%			

Two-way hourly volume, V	1444	veh/h	
Directional split	51 / 49	%	

Average Travel Speed

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.1	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor,	0.995	
Two-way flow rate,(note-1) vp	1528	pc/h
Highest directional split proportion (note-2)	779	pc/h
Free-Flow Speed from Field Measurement:		
Field measured speed, SFM	-	mi/h
Observed volume, Vf	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed, BFFS	45.0	mi/h
Adj. for lane and shoulder width, fLS	0.0	mi/h
Adj. for access points, fA	0.5	mi/h
Free-flow speed, FFS	44.5	mi/h
Adjustment for no-passing zones, fnp	1.3	mi/h

Average travel speed, ATS 31.3 mi/h

Percent Time-Spent-Following

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.0	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor, fHV	1.000	
Two-way flow rate,(note-1) vp	1520	pc/h
Highest directional split proportion (note-2)	775	
Base percent time-spent-following, BPTSF	73.7	%
Adj.for directional distribution and no-passing zones, fd/np	6.7	
Percent time-spent-following, PTSF	80.4	%

Level of Service and Other Performance Measures

Level of service, LOS	E	
Volume to capacity ratio, v/c	0.48	
Peak 15-min vehicle-miles of travel, VMT15	0	veh-mi
Peak-hour vehicle-miles of travel, VMT60	0	veh-mi
Peak 15-min total travel time, TT15	0.0	veh-h

Notes:
1. If vp >= 3200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split vp >= 1700 pc/h, terminate analysis-the LOS is F.

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Two-Way Two-Lane Highway Segment Analysis

Analyst	RSO
Agency/Co.	Traffic Management Consultant
Date Performed	11/1/2011
Analysis Time Period	AM Peak Hour W/Proposed Action
Highway	Kamehameha Highway
From/To	Hygienic Store
Jurisdiction	
Analysis Year	2025
Description	Turtle Bay Resort Master Plan

Input Data

Highway class	Class 1				
Shoulder width	6.0	ft	Peak-hour factor, PHF	0.89	
Lane width	12.0	ft	% Trucks and buses	3	%
Segment length	0.0	mi	% Recreational vehicles	0	%
Terrain type	Level		% No-passing zones	80	%
Grade: Length		mi	Access points/mi	10	/mi
Up/down		%			

Two-way hourly volume, V	1631	veh/h	
Directional split	65 / 35	%	

Average Travel Speed

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.1	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor,	0.997	
Two-way flow rate,(note-1) vp	1838	pc/h
Highest directional split proportion (note-2)	1195	pc/h
Free-Flow Speed from Field Measurement:		
Field measured speed, SFM	-	mi/h
Observed volume, Vf	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed, BFFS	45.0	mi/h
Adj. for lane and shoulder width, fLS	0.0	mi/h
Adj. for access points, fA	2.5	mi/h
Free-flow speed, FFS	42.5	mi/h
Adjustment for no-passing zones, fnp	1.1	mi/h

Average travel speed, ATS 27.2 mi/h

Percent Time-Spent-Following

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.0	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor, fHV	1.000	
Two-way flow rate,(note-1) vp	1833	pc/h
Highest directional split proportion (note-2)	1191	
Base percent time-spent-following, BPTSF	80.0	%
Adj.for directional distribution and no-passing zones, fd/np	5.0	
Percent time-spent-following, PTSF	85.0	%

Level of Service and Other Performance Measures

Level of service, LOS	E	
Volume to capacity ratio, v/c	0.57	
Peak 15-min vehicle-miles of travel, VMT15	0	veh-mi
Peak-hour vehicle-miles of travel, VMT60	0	veh-mi
Peak 15-min total travel time, TT15	0.0	veh-h

Notes:
1. If vp >= 3200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split vp >= 1700 pc/h, terminate analysis-the LOS is F.

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Two-Way Two-Lane Highway Segment Analysis

Analyst	RSO
Agency/Co.	Traffic Management Consultant
Date Performed	11/3/11
Analysis Time Period	PM Peak Hour W/Proposed Action
Highway	Kamehameha Highway
From/To	West of Kaihalulu Drive
Jurisdiction	
Analysis Year	2025
Description	Turtle Bay Resort Master Plan

Input Data

Highway class	Class 1				
Shoulder width	6.0	ft	Peak-hour factor, PHF	0.92	
Lane width	12.0	ft	% Trucks and buses	4	%
Segment length	0.0	mi	% Recreational vehicles	0	%
Terrain type	Level		% No-passing zones	50	%
Grade: Length		mi	Access points/mi	2	/mi
Up/down		%			

Two-way hourly volume, V	1473	veh/h	
Directional split	52 / 48	%	

Average Travel Speed

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.1	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor,	0.996	
Two-way flow rate,(note-1) vp	1607	pc/h
Highest directional split proportion (note-2)	836	pc/h
Free-Flow Speed from Field Measurement:		
Field measured speed, SFM	-	mi/h
Observed volume, Vf	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed, BFFS	45.0	mi/h
Adj. for lane and shoulder width, fLS	0.0	mi/h
Adj. for access points, fA	0.5	mi/h
Free-flow speed, FFS	44.5	mi/h
Adjustment for no-passing zones, fnp	0.9	mi/h

Average travel speed, ATS 31.1 mi/h

Percent Time-Spent-Following

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.0	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor, fHV	1.000	
Two-way flow rate,(note-1) vp	1601	pc/h
Highest directional split proportion (note-2)	833	
Base percent time-spent-following, BPTSF	75.5	%
Adj.for directional distribution and no-passing zones, fd/np	5.2	
Percent time-spent-following, PTSF	80.7	%

Level of Service and Other Performance Measures

Level of service, LOS	E	
Volume to capacity ratio, v/c	0.50	
Peak 15-min vehicle-miles of travel, VMT15	0	veh-mi
Peak-hour vehicle-miles of travel, VMT60	0	veh-mi
Peak 15-min total travel time, TT15	0.0	veh-h

Notes:
1. If vp >= 3200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split vp >= 1700 pc/h, terminate analysis-the LOS is F.

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Two-Way Two-Lane Highway Segment Analysis

Analyst	RSO
Agency/Co.	Traffic Management Consultant
Date Performed	11/1/2011
Analysis Time Period	PM Peak Hour W/Proposed Action
Highway	Kamehameha Highway
From/To	Haleiwa to Kawailoa
Jurisdiction	
Analysis Year	2025
Description	Turtle Bay Resort Master Plan

Input Data

Highway class	Class 1				
Shoulder width	6.0	ft	Peak-hour factor, PHF	0.96	
Lane width	12.0	ft	% Trucks and buses	2	%
Segment length	0.0	mi	% Recreational vehicles	0	%
Terrain type	Level		% No-passing zones	80	%
Grade: Length		mi	Access points/mi	2	/mi
Up/down		%			

Two-way hourly volume, V	1919	veh/h	
Directional split	51 / 49	%	

Average Travel Speed

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.1	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor,	0.998	
Two-way flow rate,(note-1) vp	2003	pc/h
Highest directional split proportion (note-2)	1022	pc/h
Free-Flow Speed from Field Measurement:		
Field measured speed, SFM	-	mi/h
Observed volume, Vf	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed, BFFS	45.0	mi/h
Adj. for lane and shoulder width, fLS	0.0	mi/h
Adj. for access points, fA	0.5	mi/h
Free-flow speed, FFS	44.5	mi/h
Adjustment for no-passing zones, fnp	1.0	mi/h

Average travel speed, ATS 28.0 mi/h

Percent Time-Spent-Following

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.0	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor, fHV	1.000	
Two-way flow rate,(note-1) vp	1999	pc/h
Highest directional split proportion (note-2)	1019	
Base percent time-spent-following, BPTSF	82.7	%
Adj.for directional distribution and no-passing zones, fd/np	4.1	
Percent time-spent-following, PTSF	86.8	%

Level of Service and Other Performance Measures

Level of service, LOS	E	
Volume to capacity ratio, v/c	0.63	
Peak 15-min vehicle-miles of travel, VMT15	0	veh-mi
Peak-hour vehicle-miles of travel, VMT60	0	veh-mi
Peak 15-min total travel time, TT15	0.0	veh-h

Notes:
1. If vp >= 3200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split vp >= 1700 pc/h, terminate analysis-the LOS is F.

HCS+: Two-Lane Highways Release 5.4

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Two-Way Two-Lane Highway Segment Analysis

Analyst	RSO
Agency/Co.	Traffic Management Consultant
Date Performed	11/1/2011
Analysis Time Period	PM Peak Hour W/Proposed Action
Highway	Kamehameha Highway
From/To	Hygienic Store
Jurisdiction	
Analysis Year	2025
Description	Turtle Bay Resort Master Plan

Input Data

Highway class	Class 1				
Shoulder width	6.0	ft	Peak-hour factor, PHF	0.99	
Lane width	12.0	ft	% Trucks and buses	5	%
Segment length	0.0	mi	% Recreational vehicles	0	%
Terrain type	Level		% No-passing zones	80	%
Grade: Length		mi	Access points/mi	10	/mi
Up/down		%			

Two-way hourly volume, V	2072	veh/h	
Directional split	57 / 43	%	

Average Travel Speed

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.1	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor,	0.995	
Two-way flow rate,(note-1) vp	2103	pc/h
Highest directional split proportion (note-2)	1199	pc/h
Free-Flow Speed from Field Measurement:		
Field measured speed, SFM	-	mi/h
Observed volume, Vf	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed, BFFS	45.0	mi/h
Adj. for lane and shoulder width, fLS	0.0	mi/h
Adj. for access points, fA	2.5	mi/h
Free-flow speed, FFS	42.5	mi/h
Adjustment for no-passing zones, fnp	0.9	mi/h

Average travel speed, ATS 25.2 mi/h

Percent Time-Spent-Following

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.0	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor, fHV	1.000	
Two-way flow rate,(note-1) vp	2093	pc/h
Highest directional split proportion (note-2)	1193	
Base percent time-spent-following, BPTSF	84.1	%
Adj.for directional distribution and no-passing zones, fd/np	3.7	
Percent time-spent-following, PTSF	87.9	%

Level of Service and Other Performance Measures

Level of service, LOS	E	
Volume to capacity ratio, v/c	0.66	
Peak 15-min vehicle-miles of travel, VMT15	0	veh-mi
Peak-hour vehicle-miles of travel, VMT60	0	veh-mi
Peak 15-min total travel time, TT15	0.0	veh-h

Notes:
1. If vp >= 3200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split vp >= 1700 pc/h, terminate analysis-the LOS is F.

HCS+: Two-Lane Highways Release 5.4

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Two-Way Two-Lane Highway Segment Analysis

Analyst	RSO
Agency/Co.	Traffic Management Consultant
Date Performed	11/5/11
Analysis Time Period	Sat Peak Hr W/Proposed Action
Highway	Kamehameha Highway
From/To	West of Kaihalulu Drive
Jurisdiction	
Analysis Year	2025
Description	Turtle Bay Resort Master Plan

Input Data

Highway class	Class 1				
Shoulder width	6.0	ft	Peak-hour factor, PHF	0.92	
Lane width	12.0	ft	% Trucks and buses	3	%
Segment length	0.0	mi	% Recreational vehicles	0	%
Terrain type	Level		% No-passing zones	50	%
Grade: Length		mi	Access points/mi	2	/mi
Up/down		%			

Two-way hourly volume, V	1828	veh/h	
Directional split	51 / 49	%	

Average Travel Speed

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.1	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor,	0.997	
Two-way flow rate,(note-1) vp	1993	pc/h
Highest directional split proportion (note-2)	1016	pc/h
Free-Flow Speed from Field Measurement:		
Field measured speed, SFM	-	mi/h
Observed volume, Vf	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed, BFFS	45.0	mi/h
Adj. for lane and shoulder width, fLS	0.0	mi/h
Adj. for access points, fA	0.5	mi/h
Free-flow speed, FFS	44.5	mi/h
Adjustment for no-passing zones, fnp	0.8	mi/h

Average travel speed, ATS 28.3 mi/h

Percent Time-Spent-Following

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.0	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor, fHV	1.000	
Two-way flow rate,(note-1) vp	1987	pc/h
Highest directional split proportion (note-2)	1013	
Base percent time-spent-following, BPTSF	82.6	%
Adj.for directional distribution and no-passing zones, fd/np	3.4	
Percent time-spent-following, PTSF	85.9	%

Level of Service and Other Performance Measures

Level of service, LOS	E	
Volume to capacity ratio, v/c	0.62	
Peak 15-min vehicle-miles of travel, VMT15	0	veh-mi
Peak-hour vehicle-miles of travel, VMT60	0	veh-mi
Peak 15-min total travel time, TT15	0.0	veh-h

Notes:
1. If vp >= 3200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split vp >= 1700 pc/h, terminate analysis-the LOS is F.

HCS+: Two-Lane Highways Release 5.4

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Two-Way Two-Lane Highway Segment Analysis

Analyst	RSO
Agency/Co.	Traffic Management Consultant
Date Performed	10/29/2011
Analysis Time Period	Sat. Peak Hr W/Proposed Action
Highway	Kamehameha Highway
From/To	Haleiwa to Kawailoa
Jurisdiction	
Analysis Year	2025
Description	Turtle Bay Resort Master Plan

Input Data

Highway class	Class 1				
Shoulder width	6.0	ft	Peak-hour factor, PHF	0.93	
Lane width	12.0	ft	% Trucks and buses	2	%
Segment length	0.0	mi	% Recreational vehicles	0	%
Terrain type	Level		% No-passing zones	80	%
Grade: Length		mi	Access points/mi	2	/mi
Up/down		%			

Two-way hourly volume, V	2124	veh/h	
Directional split	51 / 49	%	

Average Travel Speed

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.1	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor,	0.998	
Two-way flow rate,(note-1) vp	2288	pc/h
Highest directional split proportion (note-2)	1167	pc/h
Free-Flow Speed from Field Measurement:		
Field measured speed, SFM	-	mi/h
Observed volume, Vf	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed, BFFS	45.0	mi/h
Adj. for lane and shoulder width, fLS	0.0	mi/h
Adj. for access points, fA	0.5	mi/h
Free-flow speed, FFS	44.5	mi/h
Adjustment for no-passing zones, fnp	0.9	mi/h

Average travel speed, ATS 25.8 mi/h

Percent Time-Spent-Following

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.0	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor, fHV	1.000	
Two-way flow rate,(note-1) vp	2284	pc/h
Highest directional split proportion (note-2)	1165	
Base percent time-spent-following, BPTSF	86.6	%
Adj.for directional distribution and no-passing zones, fd/np	3.2	
Percent time-spent-following, PTSF	89.8	%

Level of Service and Other Performance Measures

Level of service, LOS	E	
Volume to capacity ratio, v/c	0.71	
Peak 15-min vehicle-miles of travel, VMT15	0	veh-mi
Peak-hour vehicle-miles of travel, VMT60	0	veh-mi
Peak 15-min total travel time, TT15	0.0	veh-h

Notes:
1. If vp >= 3200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split vp >= 1700 pc/h, terminate analysis-the LOS is F.

HCS+: Two-Lane Highways Release 5.4

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Two-Way Two-Lane Highway Segment Analysis

Analyst	RSO
Agency/Co.	Traffic Management Consultant
Date Performed	10/29/2011
Analysis Time Period	Sat Peak Hr W/Proposed Action
Highway	Kamehameha Highway
From/To	Hygienic Store
Jurisdiction	
Analysis Year	2025
Description	Turtle Bay Resort Master Plan

Input Data

Highway class	Class 1				
Shoulder width	6.0	ft	Peak-hour factor, PHF	0.94	
Lane width	12.0	ft	% Trucks and buses	3	%
Segment length	0.0	mi	% Recreational vehicles	0	%
Terrain type	Level		% No-passing zones	80	%
Grade: Length		mi	Access points/mi	10	/mi
Up/down		%			

Two-way hourly volume, V	2137	veh/h	
Directional split	55 / 45	%	

Average Travel Speed

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.1	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor,	0.997	
Two-way flow rate,(note-1) vp	2280	pc/h
Highest directional split proportion (note-2)	1254	pc/h
Free-Flow Speed from Field Measurement:		
Field measured speed, SFM	-	mi/h
Observed volume, Vf	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed, BFFS	45.0	mi/h
Adj. for lane and shoulder width, fLS	0.0	mi/h
Adj. for access points, fA	2.5	mi/h
Free-flow speed, FFS	42.5	mi/h
Adjustment for no-passing zones, fnp	0.9	mi/h

Average travel speed, ATS 23.9 mi/h

Percent Time-Spent-Following

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.0	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor, fHV	1.000	
Two-way flow rate,(note-1) vp	2273	pc/h
Highest directional split proportion (note-2)	1250	
Base percent time-spent-following, BPTSF	86.4	%
Adj.for directional distribution and no-passing zones, fd/np	3.2	
Percent time-spent-following, PTSF	89.6	%

Level of Service and Other Performance Measures

Level of service, LOS	E	
Volume to capacity ratio, v/c	0.71	
Peak 15-min vehicle-miles of travel, VMT15	0	veh-mi
Peak-hour vehicle-miles of travel, VMT60	0	veh-mi
Peak 15-min total travel time, TT15	0.0	veh-h

Notes:
1. If vp >= 3200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split vp >= 1700 pc/h, terminate analysis-the LOS is F.

TRAFFIC IMPACT ANALYSIS REPORT

FOR THE PROPOSED

TURTLE BAY RESORT MASTER PLAN

KAHUKU, OAHU, HAWAII

APPENDIX H

TRAFFIC SIGNAL WARRANT ANALYSIS WORKSHEET

KAMEHAMEHA HIGHWAY AND KUILIMA DRIVE

TRAFFIC SIGNAL WARRANTS

Project: Turtle Bay Resort Master Plan SEIS
Prepared By: The Traffic Management Consultant
Data Date: Start Date: 11/03/2011 (Thurs)
Major Street: Kamehameha Highway — Critical Approach Speed 35 mph — No. of Lanes 2
Minor Street: Kuilima Drive — Critical Approach Speed 25 mph — No. of Lanes 4

Critical speed on major street (mph)	≥	40	☐
			or
Population in built up area of isolated community	≤	10,000	☑

WARRANT 1 - Eight-Hour Vehicular Volume

Condition A - Minimum Vehicular Volume
(Ref.: MUTCD, Table 4C-1)

100% Satisfied	**YES** ☐	**NO** ☑
80% Satisfied	**YES** ☐	**NO** ☑
70% Satisfied	**YES** ☑	**NO** ☐
56% Satisfied	**YES** ☑	**NO** ☐

	Minimum Vehicular Volume				Hourly Vehicular Volumes							
STREET-APPROACH LANES	100%	80%	70%	56%	10:00 AM	11:00 AM	12:00 PM	1:00 PM	2:00 PM	3:00 PM	4:00 PM	5:00 PM
Major Street-1 Lane (Each Approaches)	500	400	350	280	442	495	554	657	697	640	665	512
Minor Street-2 Lanes (Each Approaches)	200	160	140	112	132	154	143	142	161	179	148	133

Condition B - Interruption of Continuous Traffic
(Ref.: MUTCD, Table 4C-1)

100% Satisfied	**YES** ☐	**NO** ☑
80% Satisfied	**YES** ☐	**NO** ☑
70% Satisfied	**YES** ☑	**NO** ☐
56% Satisfied	**YES** ☑	**NO** ☐

	Minimum Vehicular Volume				Hourly Vehicular Volumes							
STREET-APPROACH LANES	100%	80%	70%	56%	10:00 AM	11:00 AM	12:00 PM	1:00 PM	2:00 PM	3:00 PM	4:00 PM	5:00 PM
Major Street-2 Lanes (Each Approaches)	750	600	425	420	442	495	554	657	697	640	665	512
Minor Street-2 Lanes (Each Approaches)	100	80	70	56	132	154	143	142	161	179	148	133

WARRANT 2 - Four Hour Volume

(Ref.: MUTCD, Figures 4C-1 & 4C-2)

100% Satisfied	**YES** ☐	**NO** ☑
70% Satisfied	**YES** ☐	**NO** ☑

	Minimum Volume		Hourly Vehicular Volumes			
STREET - APPROACH LANES	100%	70%	1:00 PM	2:00 PM	3:00 PM	4:00 PM
Major Street - 2 Lanes (Both Approaches)	1400	1000	657	697	640	665
Minor Street - 2 Lanes	115	80	142	161	179	148

WARRANT 4 - Pedestrian Volume

Condition A - Four Hour Volumes
(Ref.: MUTCD, Figures 4C-5 & 4C-6)

100% Satisfied	**YES** ☐	**NO** ☑
70% Satisfied	**YES** ☐	**NO** ☑

	THRESHOLD VOLUME		HOURLY VOLUMES			
STREET - APPROACH LANES	100%	70%	2:15 PM	5:00 PM	6:00 PM	7:00 PM
Major Street (Both Approaches)	1100	770	836	622	536	392
Pedestrians Crossing Major Street	107	75	13	24	17	13

WARRANT 7 - Crash Experience **Satisfied** **YES** ☐ **NO** ☑

REQUIREMENT	WARRANT		Fulfilled	
One Warrant Satisfied 80%	Warrant 1-Minimum Vehicular Volume or		YES ☐	NO ☑
	Warrant 2-Interruption of Continuous Traffic or			
	Warrant 3-Minimum Pedestrian Volume			
Signal will not seriously disrupt progressive traffic flow			YES ☐	NO ☑
Adequate trial of less restrictive remedies has failed to reduce accidents frequency			YES ☐	NO ☑
Accidents within 12 month period susceptible to correction (Minimum 5 accidents*)			YES ☐	NO ☑

Socio-Economic Impact Assessment

Turtle Bay Resort Development

City and County of Honolulu, Hawai‘i

Revised ***Final Report:*** ~~***August 16, 2012***~~ ***March 2013***

Prepared by

Belt Collins Hawaii LLC

Prepared for

Lee Sichter LLC

Turtle Bay Resort LLC

EXECUTIVE SUMMARY

Proposed Action and Alternatives

This socio-economic impact assessment deals with the resort expansion proposed for Turtle Bay Resort by Turtle Bay Resort LLC. The expansion would add up to 625 hotel units, 590 resort residential and 160 community affordable housing units over time. The expansion is much smaller than the development proposed in the 1980s and currently permitted under 1986 approvals. That larger development is considered in this report as the Full Build-Out Alternative. Other alternatives studied include a Resort Residential Alternative (without any hotel units), a Conservation Partner Alternative (with development restricted to the center of the resort lands, and the feasibility of the alternative supported by funding from a hypothetical outside partner), and a No Action Alternative.

The development alternatives would be built as warranted by market demand. TBR estimates that the Proposed Action could be built and absorbed by 2025. The Full Build-Out Alternative would take much longer, with absorption estimated through 2053. The Resort Residential Alternative is estimated to be absorbed by 2025, and the Conservation Partner Alternative by 2022.

Approach

The report deals with impacts on-site at the resort, in the surrounding region, defined as the combined Koʻolau Loa and North Shore Sustainable Communities Plan areas, and, for fiscal impacts, in the City and County of Honolulu and in the State of Hawaiʻi. Impacts are estimated on the basis of Census data, current and anticipated trends in the region, data from the resort and other, comparable resorts in Hawaiʻi, and economic models developed and refined by the State's Department of Business, Economic Development and Tourism. Regional trends and impacts are estimated using forecasts by the City and County Department of Planning and Permitting and assumptions based on current conditions at the resort and in the region.

Existing Conditions

The Turtle Bay Resort currently stands as the only master planned resort community and one of the major economic drivers on the northern side of Oʻahu. The surrounding Koʻolau Loa/North Shore (KNS) region has a population of more than 34,000 residents. Its economic base is no longer agriculture, but now anchored by visitor-oriented industries The seven mile coastline to the west of the resort is recognized as the premier destination for surfing and surf competition in the world. Its surf breaks, beaches, marine life, and Haleʻiwa town are major visitor attractions. Haleʻiwa town has prospered significantly with increased visitor traffic resulting in new commercial development. On the east side of the resort, small towns dot the coastline. Lāʻie the largest and most developed community stands out as distinctive with the Hawaiʻi Temple of the

Church of Jesus Christ of Latter-day Saints, a church-based university, and the Polynesian Cultural Center (PCC), a visitor attraction that supports the Brigham Young University – Hawaii (BYUH) university campus. The entire region is characterized as "country" but is a series of rural residential communities with visitor industry businesses and pockets of agricultural production.

As is typical in a coastal area offering opportunities for surfing, sightseeing and water sports, the local housing supply includes many homes held for vacation use, as second homes or as rentals. Affordable primary homes are limited in number. Each winter, visiting surfers and the surf industry also create demand for housing in the region, competing with island residents for rental housing.

Regional unemployment rates are somewhat higher than the island average. With many residents commuting outside their home districts, average commute times are longer than the island average indicating a need for more jobs in the area. (In Lāʻie, however, the average commute was short, only 17.9 minutes in 2010 due to employment opportunities from the Polynesian Cultural Center and BYUH.) The region's share of persons living below the federal poverty level was slightly above the island level, according to data from 2006 through 2010.

Traffic congestion along Kamehameha Highway has been of concern to residents for many years. The road is narrow and has been occasionally closed due to rock falls or high surf. During the winter season there is a sharp increase in surf activity – along with visits by Honolulu residents and tourists – and resulting congestion.

Many residents' reactions to further development at Turtle Bay are generally based on both their perceptions of how it may affect their lifestyle and of challenges already facing the region: traffic, job and population growth, adequate human and health services. For some, new development is valuable as a source of jobs, both at the resort and throughout the region. Others are wary of an increase in the number of tourists or new residents in the region. All are concerned about how to manage traffic congestion effectively.

The data reviewed for the current socio-economic impact analysis indicates that local job sources fail to meet the current employment needs of many KNS residents, forcing many either to commute long distances or to leave the region to find work. Major themes of the regional socio-economic analysis provided in the 1985 Kuilima EIS (lack of employment opportunities and distance from existing employment centers) prepared 27 years ago remain valid today.

Trends Affecting the KNS Region

The island's population is expected to increase slowly in the coming decades. The O`ahu General Plan directs most new housing development to Honolulu and Leeward Oʻahu. Little change in population is expected for the region surrounding Turtle Bay. New development could occur at Lāʻie, where a proposal for an enlarged Lāʻie Inn has gained City Council approval, and plans have been put forward for expansion of Brigham Young University – Hawaii. Concept plans include renovation and expansion of BYUH, the PCC, and new residential areas to support these expansions.

Other development under way includes a few small commercial redevelopment projects in Hale‘iwa, a major wind farm in Kawailoa, agricultural and small residential subdivisions. Further proposed commercial developments appear to be stalled.

Socio-Economic Effects of the Proposed Action

This Executive Summary lays out the specific effects or impacts associated with the **Proposed Action**. Similar analyses of the alternatives are in Chapter 5 of this report.

Population

When the new development is built and occupied – by about 2025 – the Proposed Action would substantially increase the on-site population, bringing not only visitors but new resort residents and community residents to Turtle Bay Resort. (The built area and park resources would expand, so the population increase does not point to an increase in density.) The population on-site during the daytime would include visitors and residents staying at Turtle Bay, resort employees, and day visitors:

Table ES-1: Population at Turtle Bay Resort, with Proposed Action

	Existing Resort	Proposed Action, 2025	Combined
Staying at the Resort			
Visitors and Part time Residents	1,044	2,206	3,251
Full-time Resort Residents	223	55	278
Community Residents	-	638	638
Total	1,267	2,900	4,167
On-Site Daytime Population			
Visitors and Part time Residents	783	1,655	2,438
Full-time Residents	167	520	688
Operations Workers	439	561	1,000
Day Visitors	96	180	276
Daytime Total	1,485	2,916	4,401

NOTE: From Tables 4-5, 4-6. All tables in this summary bring together estimates and calculations from the body of this report. Methodology and references are shown in Chapters 4 and 5 and Appendix B. The numbers in the table are rounded, so totals may differ slightly from the sum of the numbers shown.

As of 2025, the daytime population of the existing Turtle Bay Resort (including visitors, residents, and workers on-site) would amount to 34% of the total resort population with the Proposed Action. (As of 2025, the existing resort population would amount to, 35% with the Full

Build-Out Alternative, 67% with the Resort Residential Alternative, and 46% with the Conservation Partner Alternative. When the Full Build-Out Alternative is completely absorbed (as of approximately 2053), the existing resort would account for only 14% of the total resort daytime population.

Nearly all of the resort's workers and community residents could come from the KNS region. For the purposes of impact assessment, a share of the workforce and on-site community resident population was assumed to come from other locations on O‘ahu. The new population associated with the Proposed Action would account for about 3 percent of the regional resident population, or 37 percent of the projected growth in regional population by 2025.

Employment and Wages

The Proposed Action will bring both construction jobs and continuing operations jobs, and will significantly increase payrolls in the KNS region. Construction will involve an estimated 3,263 direct jobs over 11 years. Construction wage impacts will total about $475 million. Construction workers on-site at the resort during that period will number annually about 237 on average. The number of new continuing operations positions at the resort will climb to about 753, an increase of 72 percent. In addition, visitor spending will support jobs outside the resort as well as on-site, so the attraction of additional visitors, part-time and full time residents to Turtle Bay will support an estimated 443 additional jobs in Hawai‘i by 2025. Of these, some 177 are estimated to be located in the KNS region.

In sum, visitor spending will support at least 930 new continuing jobs in the KNS region when the project is fully occupied The new jobs figure is approximately six percent of the current regional civilian labor force. Regional residents can be expected to absorb nearly all of these jobs. (Potential hires include resident workers who are now un- or underemployed and new graduates of local high schools or college programs.)

Wages from both construction and continuing jobs will support island households. After construction is completed, the regional increase in wages is expected to be at least $31 million (2011 dollars, based on $23.8 million in operations wages and $7.4 million in the KNS region for off-site tourism-related work).

Table ES-2: Employment and Wages Associated with the Proposed Action

	Cumulative, through 2025	Annual Average
Construction		
Direct Jobs	3,263	297
On-Site Direct Jobs	2,611	237
Indirect and Induced Jobs	5,482	498
Total	8,746	795
Direct Wages	$225.3	$20.5
Indirect and Induced Wages	$247.7	$22.5
Total	$473.0	$43.0
		Annual, 2025 on
Continuing Operations		
Direct Jobs at Resort		753
Indirect and Induced Jobs		785
Jobs from Off-Site Visitor Spending (Direct and Indirect)		443
Total		1,981
Continuing Jobs in KNS Region		930
Wages from Direct Jobs		$23.8
Wages, Indirect and Induced Jobs		$35.5
Wages, Off-Site Visitor Spending		$18.4
Total		$77.6
Wages, Jobs in KNS Region		$31.1

NOTES: From Tables 4-2, 4-3, 4-4, 4-14. All dollar figures are millions of 2011 $s. The numbers shown are rounded, so totals may differ slightly from the sum of the individual numbers in the table. Regional wages are for direct jobs at the resort plus a regional share of jobs from off-site visitor spending.

Housing

Regional effects would include new housing at the resort and, over time, income to support new households elsewhere in the region. By 2025, operations-related jobs (both on-site and off-site) are expected to support some 556 households in the region. While many employees will remain in the same household or succeed their parents as household heads, others will form new households. The result is estimated as formation of some 83 to 167 additional households in the

KNS region over time. The Proposed Action includes some 160 community housing units (271% of the 59 units required), so the net effect would be a significant increase in workforce housing for the regional community in the short term, and probably a reduction in housing demand over the long term.

Public Services

Population growth would bring demand for public services. Based on current service levels, that new demand from the Proposed Action would justify small increases in local public services. Table ES-3 shows the potential demand, calculated on the basis of current demand and staffing on island:

Table ES-3: New Demand for Public Services in the KNS Region with the Proposed Action

		Proposed Action, 2025
Public Schools		
2011 KNS region enrollment	4,826	
New Project-Related Enrollment, 2025		
Low Estimate		49
High Estimate		123
As share of 2011 Enrollment		
Low Estimate		**1%**
High Estimate		**3%**
Other Public Services		
Police: current number of officers/1,000 persons	1.56	
Fire: current number of officers/1,000 persons	1.07	
Emergency Medical Service: per 1,000	0.30	
Hospital Beds per 1,000 persons	2.70	
New regional demand associated with Project (New residents and visitors)		3,157
Police		4.9
Fire		3.4
Emergency Medical Services		0.9
Hospital Beds		8.5

NOTES: From Tables 4-7 and 4-15 and estimates provided in Sections 4.4.2 and 4.4.5.

Recreation

The Proposed Action includes the creation of five (5) parks all of which are open to the public. Four (4) are required by the City & County and the Master Developer is voluntarily adding an additional park; two (2) will be public parks dedicated to the City and County of Honolulu and three (3) are private parks open to the public. Four (4) of the parks are along the shoreline and are linked by a continuous shoreline easement. Up to 12 public shoreline access points, along with new parking areas, would significantly increase access to the ocean and beachfront along the resort's coastline.

A new golf clubhouse and a new equestrian center are planned to replace existing recreation facilities at the resort. The Proposed Action calls for refurbishing the Fazio Course at Turtle Bay as a nine-hole course. With the number of visitors staying at the resort expected to increase while the number of golf holes is reduced from 36 to 27, golf tee times would likely become less available to visitors and residents on O‘ahu.

Fiscal Impacts

New development brings capital to Hawai‘i for construction. Resort facilities attract visitors and new resort residents, whose spending continues for the lifetime of the resort. These cash flows are taxed both immediately (e.g., General Excise Tax on construction and on goods sold to visitors, Transient Accommodations Tax, Real Property Tax on new development) and over time (e.g., Income taxes paid by workers in direct, indirect and induced jobs supported by visitor spending).

The City and County and the State both spend considerable amounts on services that benefit residents and visitors. Government costs for services to new visitors and new resort residents at Turtle Bay Resort can be estimated based on the size of these populations. (Community housing residents will already be island residents. This component of the Proposed Action would not generate new costs for local government.)

Currently, the City and County of Honolulu collects about $12.4 million in real property taxes annually from residential and resort properties in the KNS region. As of 2025, real property taxes on residential and resort units within the Proposed Action would amount to an addition of about $8.3 million annually, a major increase (67%) in funds available to support municipal services.

The Proposed Action will result in a cumulative net benefit – i.e., total benefits minus total costs – for the period 2014 to 2025 estimated as $163.4 million for the State of Hawai‘i and as $45.6 million for the City and County of Honolulu (in 2011 dollars). After full occupancy has been reached, the annual net benefit for the State will amount to $14.6 million, while the annual net benefit for the City and County will be about $6.6 million.

Table ES-4: Revenues and Costs Associated with the Proposed Action

	Cumulative, through 2025 *Million $ (2011)*
State Revenues	
Excise Tax	$84.1
Income Tax	$55.5
Transient Accommodations Tax	$32.9
Transient Occupancy Tax	$16.3
Conveyance Tax	$5.1
	$193.9
Costs for State	
For Visitors	$27.6
For New Residents	$2.8
	$30.5
Net Benefit (Revenues > Costs)	$163.4
Ratio of Benefits to Costs	6.4
City and County Revenues	
Excise Tax	$9.3
Real Property Tax	$50.3
	$59.7
Costs for City and County	
For Visitors	$13.5
For New Residents	$0.6
	$14.1
Net Benefit (Revenues > Costs)	$45.6
Ratio of Benefits to Costs	4.2

NOTES: All dollar values are in constant 2011 dollars.. See Tables 4-8 through 4-13 for details. The numbers shown are rounded, so totals may differ slightly from the sum of the individual numbers in the table.

Impacts on Community Life in the KNS Region

The Koʻolau Loa-North Shore region is famed for "country" atmosphere along with its beaches and surf spots. The Turtle Bay Resort currently fits into that atmosphere in many ways. Its beaches and waters are enjoyed by residents as well as visitors. It provides amenities enjoyed by

regional residents. It provides jobs on-site. With wages and benefits protected by union contracts, the resort sets the bar for local employment practices. Its guests contribute to visitor spending for goods and services throughout the region.

The Proposed Action would have several results that would generally be considered beneficial for local communities, above all:

- Job-creation.
- New housing designed for community residents.
- Development of new amenities which could be used by residents and tend to increase visitors' time at the resort (vs. on the North Shore roadways), notably:
    - New beach parks with parking and shoreline access, greatly improving access to both open coastline and an enclosed bay;
    - A Gathering Place combining performance space, stores and other uses; and
    - An on-site Farmers' Market.
- Attraction of upscale visitors who value the North Shore as a place to stay, not just to visit for a few hours.
- Attraction of resort residents and homeowners, a few of whom would likely contribute their support to community causes. (Elsewhere in Hawai'i, such contributions can range for funds for local hospitals to fervent support of environmental groups.)

All of these can contribute to a more prosperous regional community. With shorter commutes, many residents have more time to spend with family and neighbors, and to participate in community life.

Drawbacks of new development may include increased traffic and more visitors in regional communities. The traffic impact assessment for the SEIS estimates both existing traffic congestion and the impact of new resort development. It identifies traffic management strategies to reduce the project's contribution to this regional problem.

Mitigation of Adverse Impacts

Mitigation measures are part of the Proposed Action and all the development alternatives. The Master Developer and City have entered into an Unilateral Agreement (UA) associated with the resort expansion which requires park development, workforce housing development, employment training to insure that jobs go to regional residents, child care, and traffic management measures. The Master Developer has always agreed to implement the UA conditions. As stated previously, the Master Developer has voluntarily agreed to exceed the UA requirements by adding parks, more access points to the shoreline and additional community housing in the Proposed Action. (The Proposed Action includes 160 community housing units, 101 more than the 10% share of resort residential units mandated by the UA.) Specific programs

for employee training and child care will need to be designed to meet the needs of the workforce in the next years.

The developer is working with the State Department of Transportation and their traffic engineer team to identify traffic impacts and find traffic management strategies to minimize them.

Addressing those impacts calls not just for technical solutions, but for a process of community dialogue. Effective mitigation measures involve consultation and shared assessment of what works.

The vision of the future presented to the community by TBR in the SEIS combines a holistic view of the land and people, an emphasis on stewardship, and a commitment to consultation with elders, neighbors, and other stakeholders. It identifies relationships and discussions that seem well suited to mitigation as an ongoing process of sustaining the land and people of the area. TBR has already discussed plans with a wide range of community members, and is continuing both consultation with elders and involvement others in the community. In sum, TBR has identified, and taken steps to put in place, a promising framework for effective mitigation and responsible development.

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ABBREVIATIONS AND ACRONYMS

ACS	American Community Survey (annual survey of a sample of the population). The ACS may be reported in annual, three-year, and five-year increments, with smaller areas reported for the longer periods. ACS data in this report comes from the 2006-2010 surveys. The ACS includes the "long-form" data sets that had been gathered from a sample of the population in the decennial census before 2010.
BCH	Belt Collins Hawaii
BYUH	Brigham Young University – Hawaii
CDP	Census Designated Place
CT	Census Tract
DI	Direct and indirect (in Input-Output Analysis)
DII	Direct, indirect and induced (in Input-Output Analysis)
DBEDT	Hawai‘i State Department of Business, Economic Development and Tourism
DPP	City and County of Honolulu Department of Planning and Permitting
EIS	Environmental impact statement
FT	Full-time (used for full-time resort residents, treated as Hawai‘i residents)
KNS	Ko‘olau Loa/North Shore combined area
KNSSPC	Kuilima/North Shore Strategy Planning Committee
Kuilima EIS	Group 70. *Revised Environmental Impact Statement, Kuilima Resort Expansion.* Honolulu, HI 1985.
PCC	Polynesian Cultural Center
PT	Part-time (used for part-time residents and second homeowners, treated as visitors to Hawai‘i in economic analyses)
SCP	Sustainable Communities Plan. The City and County of Honolulu recognizes seven regional planning areas: two Development Plan areas and five SCP areas.
SIA	Socio-economic impact assessment
SEIS	Supplemental environmental impact statement
SEIS lands	Land area covered by the SEIS for Turtle Bay Resort; smaller than the TBR landholdings, but also including portions of right-of-way along Marconi Road.. Area shown in SEIS and SEISPN.
SEISPN	Supplemental Environmental Impact Statement Preparation Notice. For Turtle Bay, the SEISPN was prepared by Lee Sichter LLC and published via *the Environmental Notice* on August 23, 2011.
TBR	Turtle Bay Resort LLC
UA	Unilateral Agreement (by developer, in connection with zoning decisions by the City and County of Honolulu). The Kuilima UA (No. 86-99) was recorded in September 1986.

1 Introduction

1.1 Purpose of the Analysis

The Turtle Bay Resort, located at the northern point of the island of O‘ahu, consists of (a) developed lands, including the Turtle Bay Hotel (with 500 units, including hotel rooms, cottages, and the Ocean Villas condominiums), two townhouse developments (Kuilima Estates East and Kuilima Estates West, totaling 368 units), and two 18-hole golf courses (Fazio and Palmer), along with (b) additional areas for which development has been proposed and land use permits and approvals were granted~~, and (c)~~.[1] A separate entity owns additional agricultural land on the *mauka* (inland) side of Kamehameha Highway.

The major land use permits for proposed development were issued in the mid-1980s. The proposed development included additional hotel properties, resort residential housing, parks, and public shoreline access ways. In the intervening years, only modest development and redevelopment has occurred. In 2006, the resort’s owner received preliminary City and County of Honolulu approval to subdivide approximately 700 acres to implement the previously approved Master Plan. This was a necessary step towards further development of the land. The subdivision approval was then challenged in court, on the grounds that the 1985 Environmental Impact Statement (the “Kuilima EIS”) was no longer an adequate basis for government decision-making. The Hawai‘i Supreme Court ruled in 2010 that a Supplemental Environmental Impact Statement (SEIS) had to be prepared and accepted before subdivision could occur.

Turtle Bay Resort LLC (TBR) is preparing an SEIS for their newly Proposed Action, the project. This report, a socio-economic impact assessment, has been prepared as part of the SEIS and will be presented as an appendix to that document.

Typically, a socio-economic impact assessment (SIA) deals with proposed development of lands from less intensive use to new, more intensive uses. A typical SIA report deals with impacts of new development, and of conversion of non-urban lands to urban uses. The current situation is different, in at least four respects:

- The site is not a physical or legal green field: the majority of the site is disturbed with parts of the resort developed from 1970 to 2005. The larger area covered by a 1986 agreement and zone change ordinance has been recognized as a future resort destination for decades.

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[1] The resort was known as the Kuilima Resort in the 1970s and 1980s. In this assessment, the “Kuilima EIS” refers to the *Kuilima Resort Revised Final Environmental Impact Statement* published in 1985 and accepted by the City and County of Honolulu Department of Land Utilization. Any reference to the “Kuilima” development similarly deals with the plans accepted in the 1980s.

Words and names of Hawai‘ian origin are spelt here with diacriticals to mark long vowels and glottal stops, except when referring to a source or agency that omits these.

- The 1985 Kuilima EIS provides assessments of potential impacts of development that may or may not be relevant to the current Proposed Action and Alternatives or to the current and emerging context;

- A 1986 Unilateral Agreement (UA) identified specific actions to mitigate adverse impacts of the Kuilima development. The developer agreed to implement those mitigations as part of the new development proposed at that time.[2]

  The UA runs with the land, meaning that it must be implemented as agreed when development takes place, unless formally amended by the Honolulu City Council. The UA mitigations will be assessed in the course of this report in relation to various development scenarios.

- The SEIS considers a Proposed Action, ~~and~~ three development alternatives (summarized in Section 2.1), and a No Action alternative, not just a Proposed Action and a No Action Alternative.

Figure 1-1 shows the resort's location on O'ahu. Figure 1-2 shows the zoning of the Turtle Bay lands and the location of the Turtle Bay Hotel and Kuilima Estates townhouse development. The Turtle Bay SEIS deals with areas *makai* (seaward) of Kamehameha Highway, and not the agricultural lands *mauka* (inland) of the highway.

An Environmental Impact Statement (EIS) is a disclosure document, intended to help decision-makers and the general public consider the implications of new development. The Turtle Bay SEIS provides analysis of a Proposed Action and three development alternatives. This SIA will evaluate not only effects of the Proposed Action, but also ones associated with the other alternatives considered in the SEIS as well as the No Action alternative.

1.2 Objectives and Approach

The Kuilima EIS included a lengthy SIA. This report updates that SIA by dealing with current proposals and conditions. Major issues and concerns discussed in the Kuilima SIA will be reviewed here, to assess their relevance to the new proposed action and alternatives.

Sources for the report include public records, information from interviews with Turtle Bay stakeholders and members of the surrounding community, and accounts of alternatives provided by TBR. The report also draws on other studies conducted for the SEIS, notably an updated market study and an updated traffic impact assessment.

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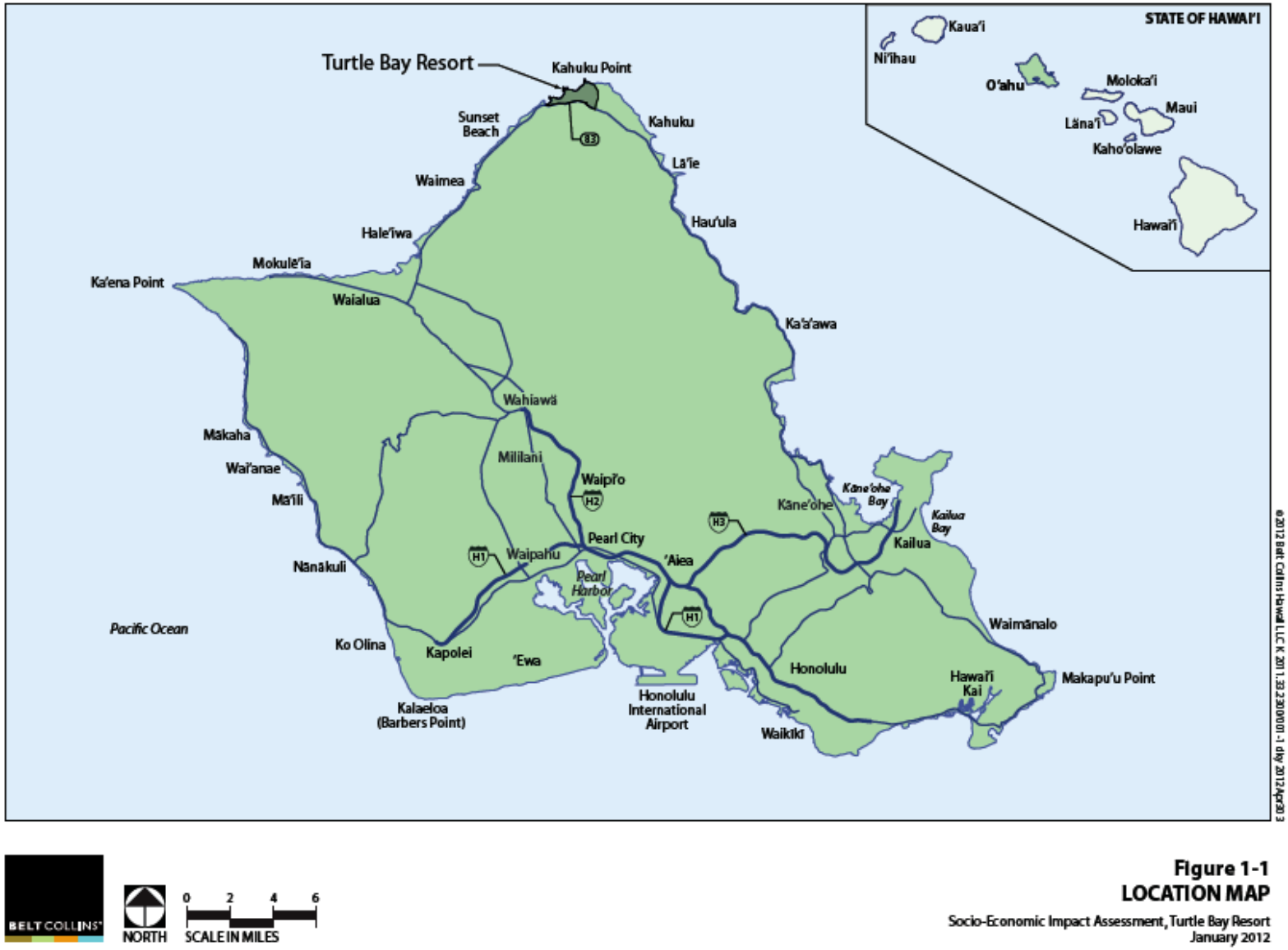
[2] "The developer" is here understood to be Kuilima Development Company, which built the Turtle Bay Hotel and the Kuilima Estates townhouses, along with its successors, including Kuilima Resort Company, which obtained further development permits in the 1980s, eventually culminating in Turtle Bay Resort LLC. While these are different entities, the differences among them are not at issue herein.

The approach taken here is intended to provide the SEIS authors with information sufficient to identify and disclose the anticipated socio-economic impacts of the Proposed Action. However, the term "impact" should be understood in relation to the project's history.

Figure 1-1: Location Map



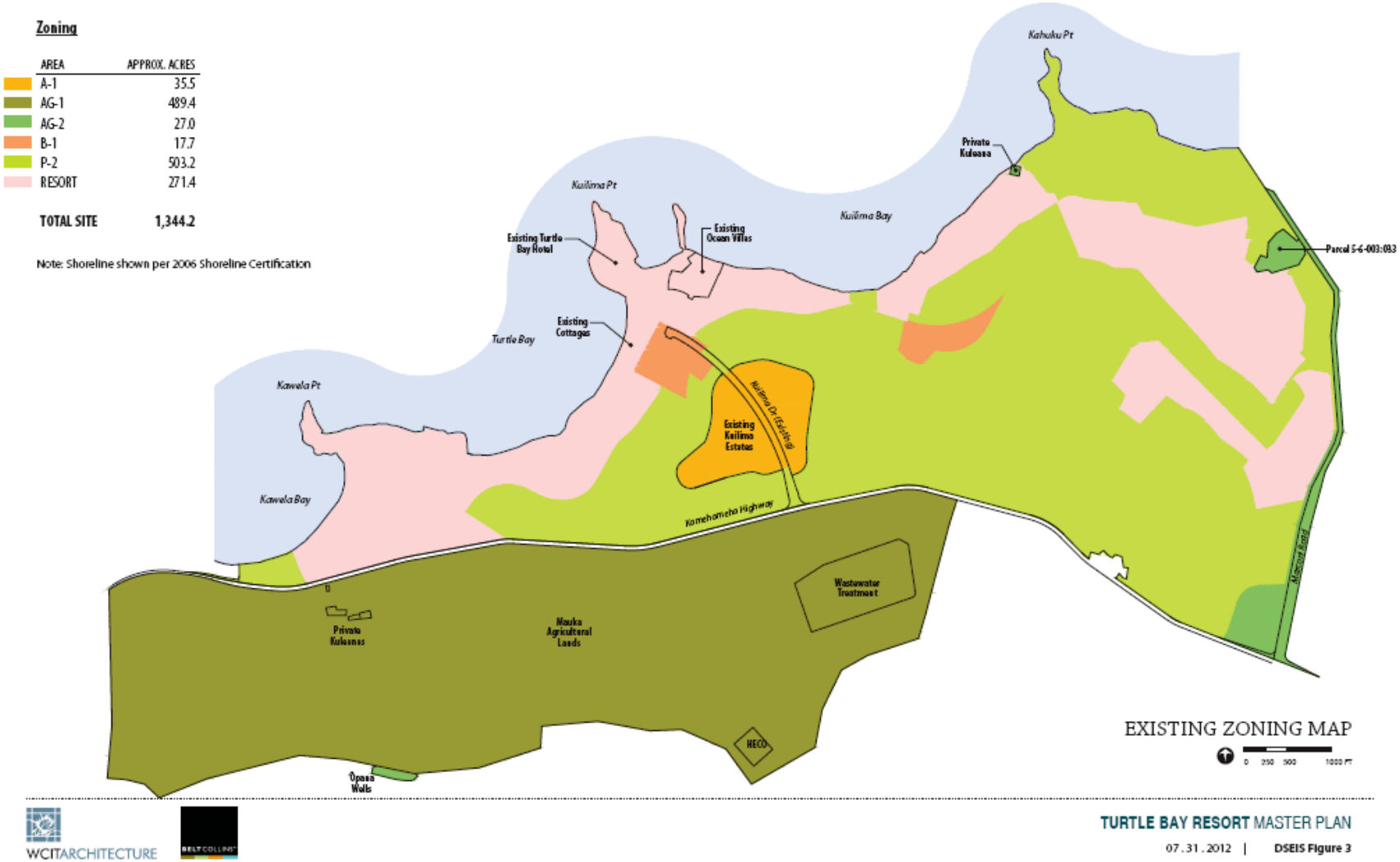
BELT COLLINS

NORTH

0 2 4 6
SCALE IN MILES

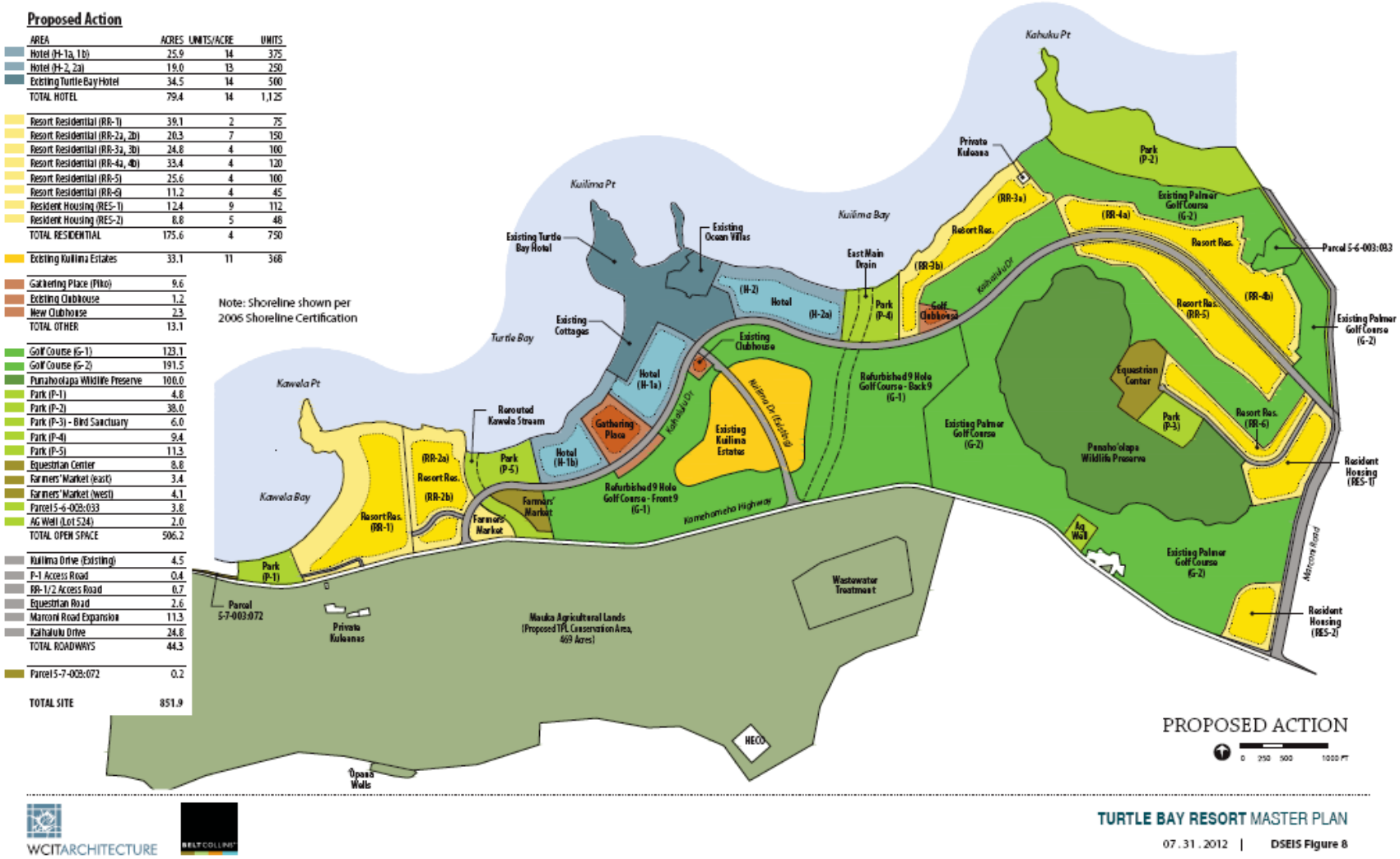
Figure 1-1
LOCATION MAP
Socio-Economic Impact Assessment, Turtle Bay Resort
January 2012

Figure 1-2: Existing Zoning Map



SOURCE: Lee Sichter LLC. *Turtle Bay Resort Environmental Assessment & Supplemental Environmental Impact Statement Preparation Notice.* August 2011.

Figure 1-3: Proposed Action



SOURCE: Lee Sichter LLC. *Turtle Bay Resort Environmental Assessment & Supplemental Environmental Impact Statement Preparation Notice.* August 2011. Figure updated August 2012.

Normally, an impact is understood as an effect of proposed development measured as the difference between the future with project and the likely future without the project. Information about ongoing trends in the surrounding community and consideration of the No Action Alternative normally are enough to sketch the relevant future without the project. In the present case, the future is not so simple. The Hawai‘i Supreme Court ruled that a supplemental EIS is needed *before subdivision can be approved* by the City and County of Honolulu. The ruling calls for new information and analysis, but does not void existing permits. Once the SEIS is accepted, those permits could allow for development of what is termed here the Full Build-Out Alternative. Strictly speaking, then, the "impact" of the Proposed Action involves reducing the amount of development from that allowed under the Full Build-Out Alternative, rather than increasing development over the level found in the No Action Alternative.

The situation is further complicated by the Unilateral Agreement (UA) associated with the 1986 rezoning. The developer agreed to make roadway improvements, to assure beach access, to provide housing and parks, and to provide transportation management mitigations and a child care center in connection with planned development. These actions are part of the likely future under all development alternatives unless the Honolulu City Council amends the UA.

The accepting agency for the SEIS (in this case, the City's Department of Planning and Permitting) will determine whether the SEIS has fulfilled the process and content requirements specified by law. The developer and the City and County of Honolulu will ultimately review the proposed development in light of the UA, and seek to implement or adapt the UA to the new proposal and circumstances as seems appropriate to them.

TBR has planned the Proposed Action after careful consideration of the range of actions possible under existing permits. It has chosen the Proposed Action in light of the resources of the property along with concerns about the quality of visitors' experiences, community-resort relations, market conditions and financial return.

For the rest of this report, contrasts will be identified for the Proposed Action, three Development Alternatives, and the No Action Alternative. Effects of the Proposed Action will be discussed mainly in contrast to the Full Build-Out Alternative (i.e., development according to existing permits) and to the No Action Alternative. "Effects" point to contrasts between the Proposed Action, current conditions, and alternatives under study, while "impacts" suggests that the Proposed Action must be considered in relation to a single current or future baseline.

1.3 Organization

The report consists of:

- This introduction;
- A brief account of the Proposed Action and Alternatives;

- An account of existing and anticipated conditions in the area surrounding the proposed development;

- Assessment of potential social and economic effects of the Proposed Action for the resort, nearby properties, the surrounding Koʻolau Loa/ North Shore region, and the economies of Oʻahu and the state of Hawaiʻi;

- Similar assessment of effects for the other alternatives;

- Consideration of the application of the SIA analysis in the 1985 Kuilima EIS to the existing context of development and the Proposed Action and alternatives currently under study, with assessment of the relevance of socio-economic mitigations in that EIS to the Proposed Action and the new alternatives; and

- Discussion of potential mitigation measures suggested in the course of the study, taking into account the extent to which they may mitigate effects of the Proposed Action and each development alterative.

2 Action and Alternatives Considered

Turtle Bay Resort LLC (TBR) has identified a Proposed Action and alternatives for consideration. The Proposed Action involves less development and less dense development than the Full Build-Out alternative. (The Full Build-Out alternative corresponds to the Kuilima development presented in the 1985 Kuilima EIS and subsequently granted land use approvals.) The *Supplemental Environmental Impact Statement Preparation Notice* (published on August 8, 2011 to commence the SEIS process) identified a total of five concepts:

1. Proposed Action
2. Full Build-Out Alternative
3. Resort Residential Alternative
4. Kawela Conservation Alternative
5. No Action Alternative

The Kawela Conservation Alternative was intended to respond to some residents' interest in limiting the scale of development. As discussions have continued, it has become clear that some stakeholders wanted an alternative that restricts new development on both the Kawela and Kahuku sides of the property. Accordingly, the developer worked with these groups to define a new alternative and now the SEIS includes a Conservation Partner Alternative, instead of the Kawela Conservation Alternative. It is called the "Conservation Partner Alternative" because it would depend on involvement of a future, as yet unknown, financial partner who is prepared to provide economic consideration in return for preservation: Turtle Bay Resort could not implement it without outside support.

Table 2-1 provides a summary of resort development and the park spaces in the various alternatives. Figures 2-1 through 2-5 are reduced versions of the alternative concept plans developed for TBR by its design consultants.

The summary in Table 2-1 and much of the discussion in this section treats alternatives as varying types and densities of development within the resort lands as a whole. Planning for the proposed action has included consideration of the resources, opportunities and constraints of subareas within the SEIS lands, and a vision of the TBR properties in terms of *ahupua'a*. Three areas within the SEIS lands are viewed as parts of separate *ahupua'a*, as shown in the map in Figure 2-3.

Table 2-1: Development Summary

	Proposed Action	Full Build Out Alt.	Resort Residential Alt.	Conservation Partner Alt.	No Action Alt.	Kawela Conser-vation Alt.
Existing						
Hotel Units	500	500	500	500	500	500
Residential Units	368	368	368	368	368	368
Proposed						
Hotel Units	625	2,500	-	440	-	625
Resort Residential Units	590	910	454	252	-	565
Resident Housing Units	160	90	46	48	-	160
Park (acres)	69.5	50.8	50.8	59.7	-	73.3
Preserve (acres)	100.0	100.0	100.0	100.0	N/A	120.2
Golf Courses (Holes)	27	36	36	18	36	27

NOTE: The Kawela Conservation Alternative is listed here because it was considered during interviews for the report. It is not treated as an alternative in the SEIS; the Conservation Partner Alternative replaces it.
SOURCE: Adapted from SEIS Preparation Notice and information from TBR.

2.1 Proposed Action

The Proposed Action as shown in Figure 1-3 is based on a Revised Master Plan that includes two hotel parcels adjacent to the Turtle Bay Hotel,[3] resort residential development on the Kawela and Kahuku sides of the property, a Gathering Place including shops, restaurants, and an ocean sports club integrated with one of the hotel parcels, parks, and day care center for employees' children. Also, a farmers' market is proposed.

The UA calls for 10 percent of housing developed to be available for the local community, at rates affordable to families earning 80 percent or more of the area median income. The Proposed Action would trigger an obligation of 59 affordable housing units. However, the Proposed Action provides for 160 "community residential" units, including units built on-site and lots developed for self-help housing construction, along with 590 resort residential units. This is an appreciably larger share of new homes for community residents than in the UA requirement. While the "community residential" units would meet the income criteria in the UA, TBR hopes that their cost could be lower, in line with the needs of local residents.

A new golf clubhouse is proposed near the 18th green of the Palmer Course. The Fazio course would be reconfigured as a nine-hole course. Parks and the wildlife preserve would be developed as shown in Figure 1-3. Additional information about the developers' concepts, open space and infrastructure is provided in the SEIS.

[3] The two hotels could be operated as a time share and a condominium property. The specifics of their operations will depend on market conditions.

~~The Proposed Action is part of a comprehensive property, natural and cultural resources management plan created by the developer, entitled "Tomorrow's Ahupua'a," for all the TBR lands, including agricultural lands inland from the resort.~~ The Proposed Action was informed by an overarching philosophy of responsible and sustainable development embraced by the developer entitled "Tomorrow's Ahupua`a." Elements of that plan include environmental stewardship, farm-to-table programs, and "respectful" planning for Kawela Bay and Punaho'olapa Marsh. The plan includes continuing review of and input on operations and design by community stakeholders and experts. It aims to integrate the resort into the local community as "equally welcoming to locals from neighboring communities as to visitors from afar," as "sensitive to the environment and respectful to the host Hawaiian culture" and as a source of employment and business for local residents.[4] Tomorrow's Ahupua`a provides responsible guidelines for action to preserve and enhance environmental, social and cultural resources.

TBR forecasts absorption of a total of 1,375 new hotel and residential resort units, 61% less than current approvals, as of 2025. Accordingly, construction is expected to occur from 2014 through 2024. (For all development alternatives, construction is assumed to end the year before full absorption.)

2.2 The Full Build-Out Alternative

The Full Build-Out Alternative realizes the land use entitlements approved in the 1986 rezoning and Unilateral Agreement (five new hotel parcels totaling 2,500 new units, 1,000 new residential units, with both resort and local resident housing on-site, new Palmer golf clubhouse, a beach club and a commercial area). (The UA would allow the local resident housing to be off-site.)

TBR forecasts absorption of a total of 3,500 new hotel and residential resort units in the Full Build-Out Alternative as of 2053. Construction is expected to occur from 2014 through 2052.

2.3 Resort Residential Alternative

The Resort Residential Alternative involves development of the resort with no additional hotels. The count of resort residential units is only 454; many would be large-lot homes. Some 46 community residential homes would also be developed, representing ten percent of the market housing.

TBR forecasts absorption of the new residential units in the Resort Residential Alternative as of 2025. Construction is expected to occur from 2014 through 2024.

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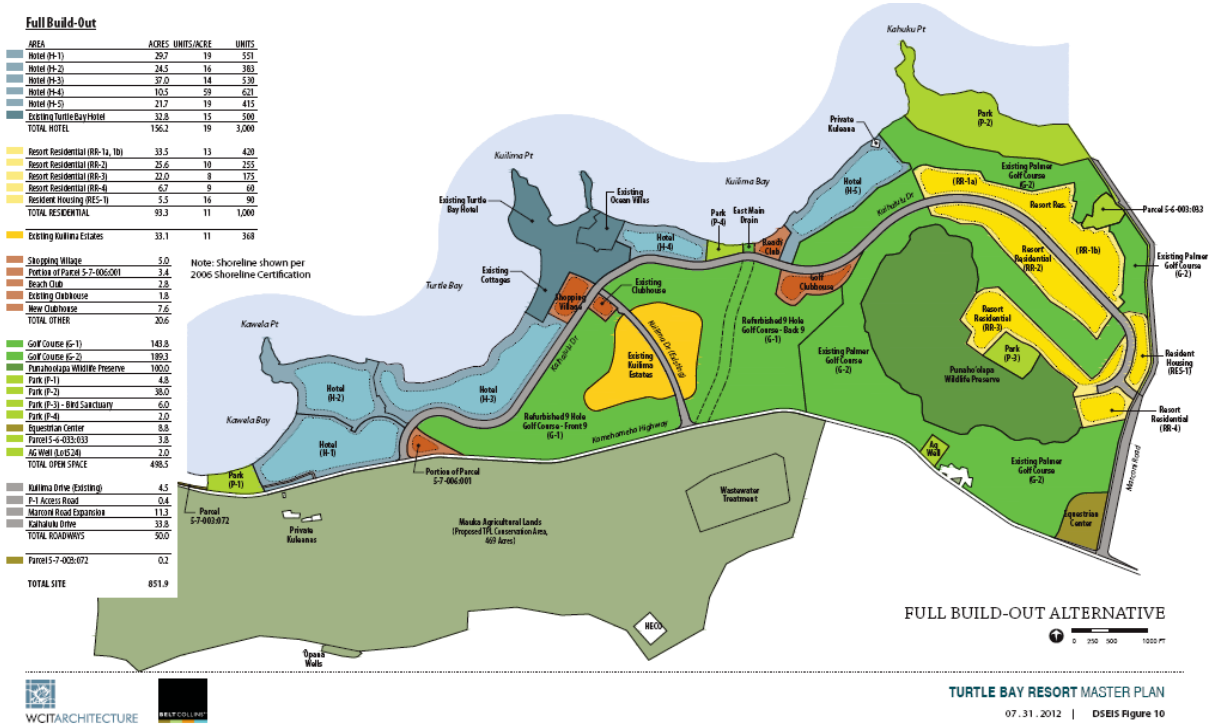
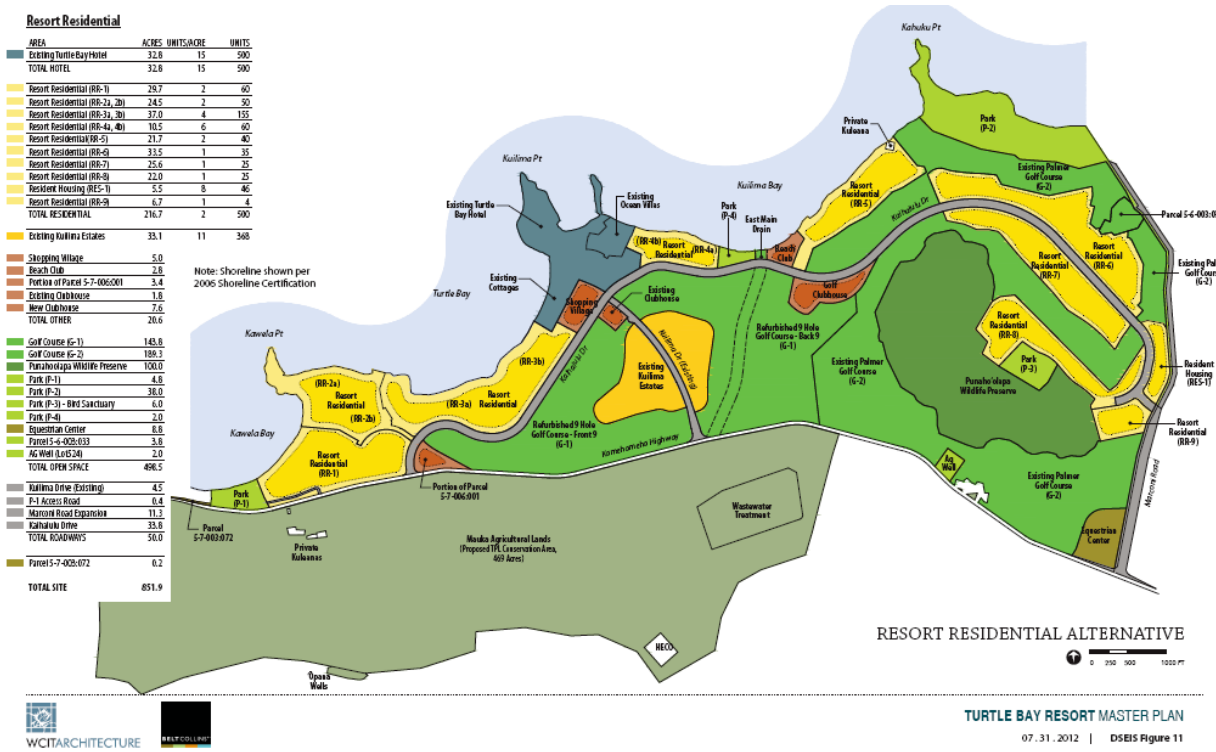
[4] Lee Sichter LLC. *Environmental Assessment & Supplemental Environmental Impact Statement Preparation Notice.* Prepared for Turtle Bay Resort LLC. Page 12. Posted at http://oeqc.doh.hawaii.gov/Shared%20Documents/EA_and_EIS_Online_Library/Oahu/2010s/2011-08-23-FEA-SEISPN-Turtle-Bay-Expansion.pdf.

Figure 2-1: Full Build-Out Alternative



SOURCE: TBR.

Figure 2-2: Resort Residential Alternative



SOURCE: TBR.

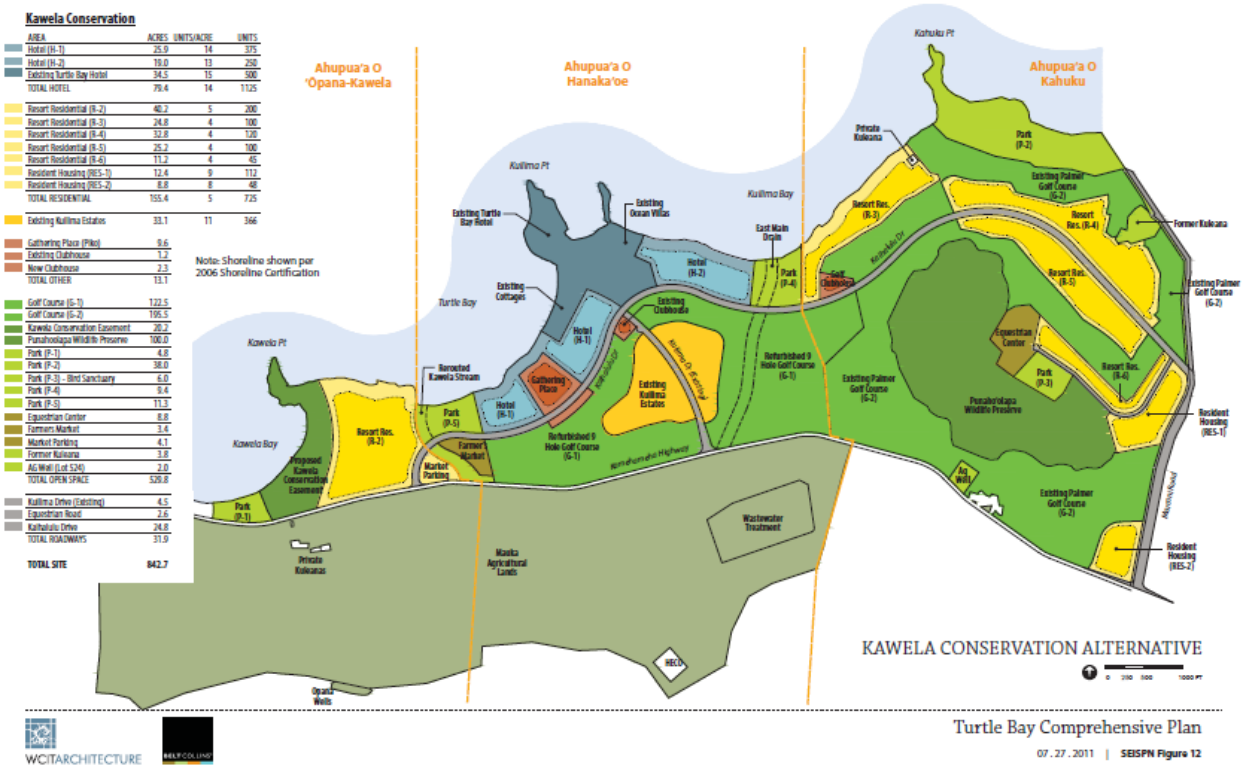
2.4 Conservation Alternatives: The Kawela Conservation Alternative and the Conservation Partner Alternative

The Kawela Alternative was conceived as a conservation alternative, since it kept new development away from Kawela Bay. The Conservation Partner Alternative goes farther than the Kawela Alternative, increasing the conservation area acreage near Kawela Bay and limiting new development on the Kahuku side of the property to open space, recreation and community residential homes.

The Conservation Partner Alternative includes large areas of open space at the east and west sides of the SEIS lands. No plan for the use and maintenance of that space has been advanced. Turtle Bay Resort LLC has indicated that this concept could be realized only with the active financial participation of a partner able to contribute significant funds to compensate the owner for extinguishing development rights, to achieve both conservation and the success of the scaled-down resort.

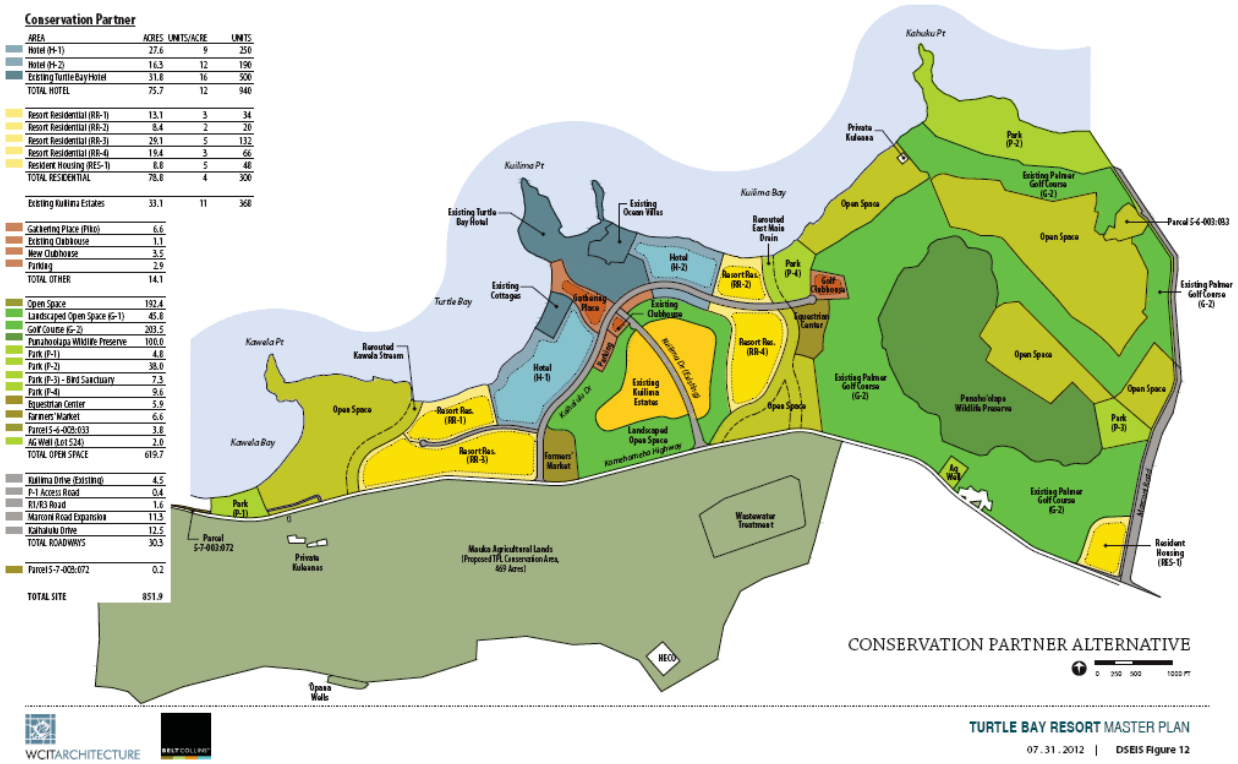
TBR forecasts absorption of 440 new hotel units and 300 new residential units in the Conservation Partner Alternative as of 2022. Construction is expected to occur from 2014 through 2021.

Figure 2-3: Kawela Conservation Alternative (Now Superceded)



SOURCE: Lee Sichter LLC. *Turtle Bay Resort Environmental Assessment & Supplemental Environmental Impact Statement Preparation Notice.* August 2011.

Figure 2-4: Conservation Partner Alternative

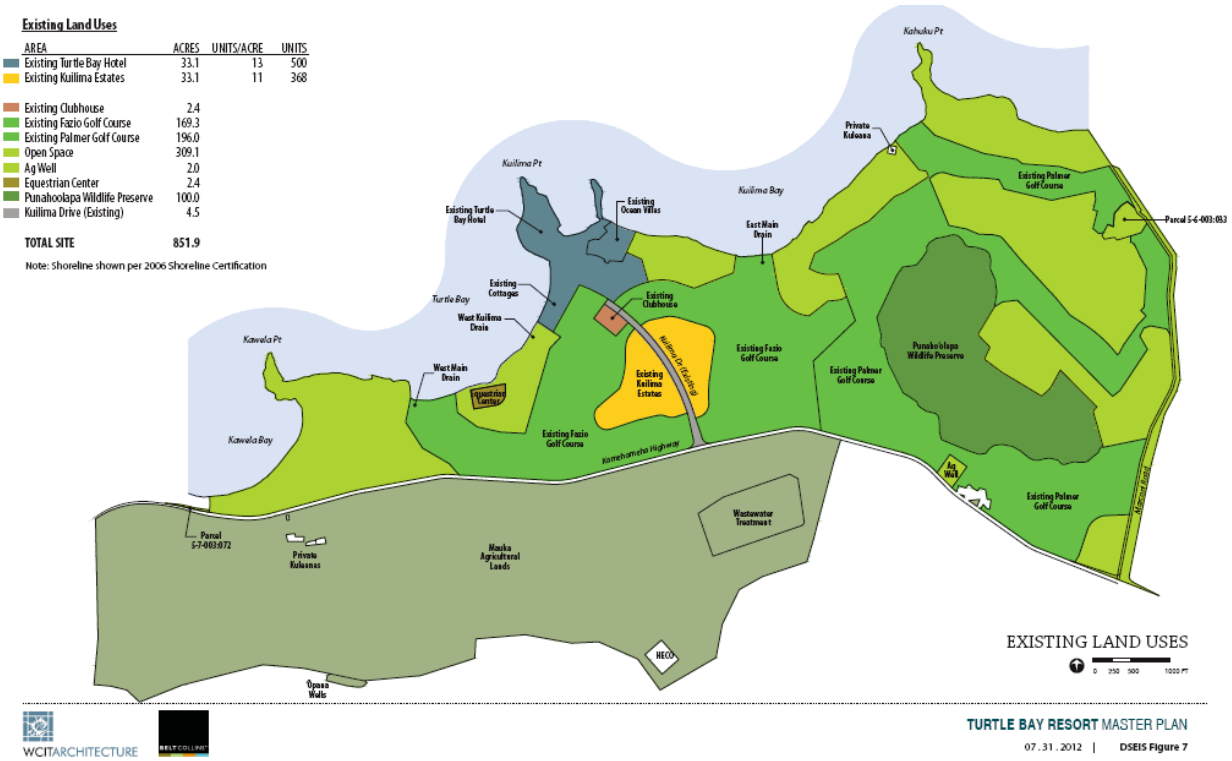


SOURCE: TBR.

2.5 No Action Alternative

The No Action Alternative would involve no further development of the lands in the SEIS. The No Action Alternative would result in the continuation of the resort in the form that exists today Golf and equestrian facilities would not be redeveloped. The parks and housing identified in the 1986 UA are not included, since these are tied to new development.

Figure 2-5: Existing Conditions / No Action Alternative



SOURCE: TBR.

3 Socio-Economic Context

3.1 Regions Potentially Affected

The Turtle Bay Resort is located outside the town of Kahuku and near the boundary between the Koʻolau Loa and Waialua (or North Shore) Districts. In this report, the combined districts – the Koʻolau Loa/North Shore (KNS) region – will be treated as the area most likely to be affected by change at the Resort. Attention is given to effects on the existing resort, on Kahuku, and other communities, and on particular groups within the region. In this introductory chapter, characteristics of the region and some of its geographic variation are highlighted.

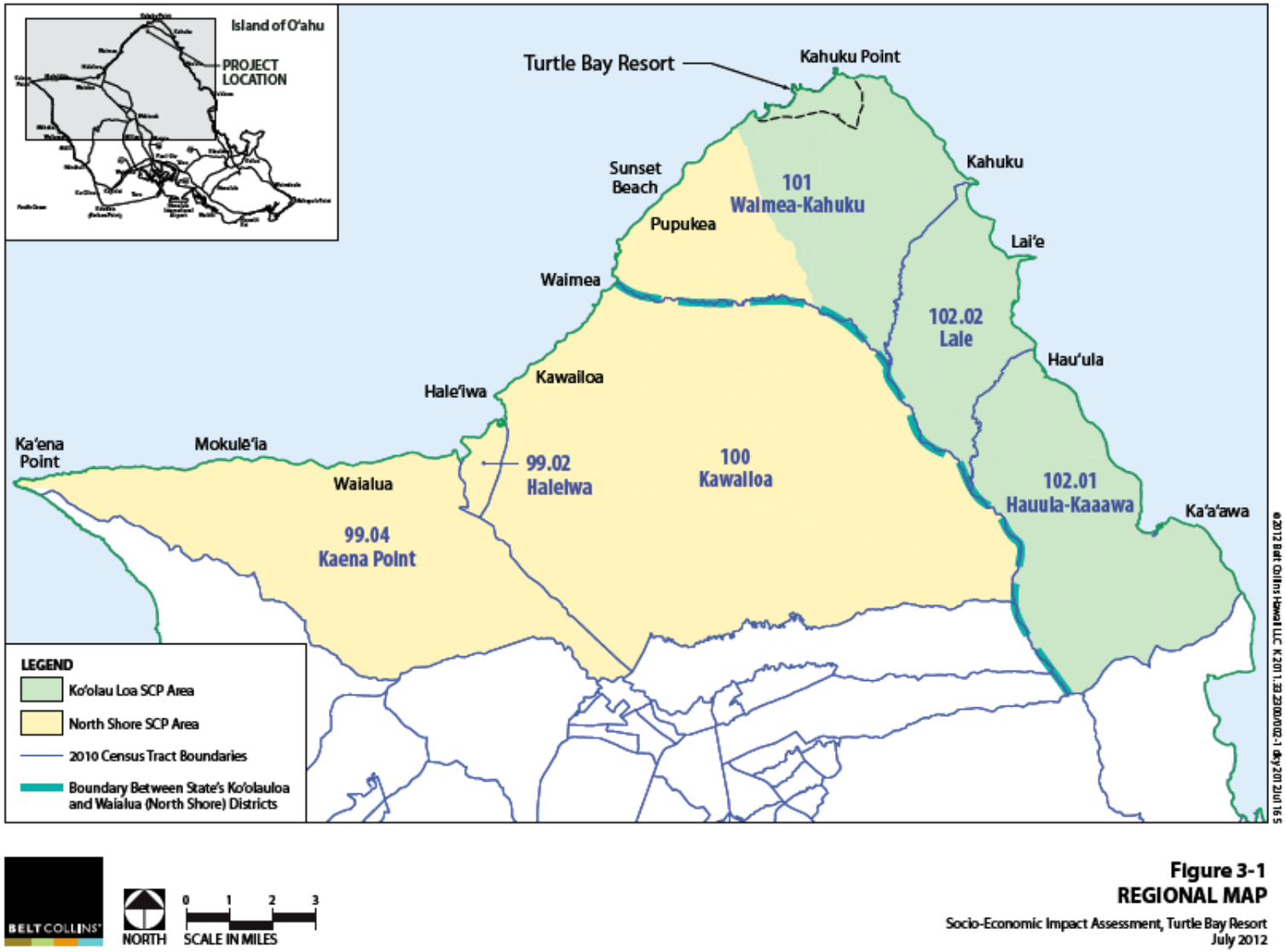
The economic consequences of development would extend beyond the region to the remainder of the City and County of Honolulu and the State of Hawaiʻi. These are charged to provide public services to the region; they would collect taxes and fees from the development.

Figure 3-1 shows the region, major communities, and subareas recognized by the U.S. Census and local government. It shows also a source of possible confusion: State and City definitions of local regions diverge. The City and County of Honolulu recognizes Sustainable Communities Plan (SCP) Areas, with a boundary just west of the Resort; the State of Hawaiʻi recognizes judicial districts – and, following the state, the U.S. Census identifies census tracts – with Waimea Bay at the western limit of the Koʻolauloa District.[5]

In most of this section, the discussion deals with the KNS Region, and with particular Census Tracts or communities within it. The two SCP Areas can be contrasted, with Koʻolau Loa characterized as a network of small, rural communities, while the North Shore is deeply affected by its role as the surfing capital of the world. However, in many ways, residents of the region as a whole share a commitment to their area and to a rural lifestyle. Also, differences among adjacent communities within each Area also deserve notice, so a two-Area approach to the region misses important differences within each Area and similarities among some of the communities along the coastline.

[5] Appendix A, Table A-1 identifies the relationship between specific communities and the various federal, state and county boundaries. The City and County of Honolulu uses the spelling Koʻolau Loa, while the State uses Koʻolauloa. The former spelling is used here except when referring to the State's judicial district. The City's approach, which treats Sunset Beach and Pupukea as part of the North Shore, rather than of Koʻolau Loa, seems to fit most regional residents' views better than the State's boundaries.

Figure 3-1: Regional Map



NOTE: Census Tract boundaries follow the State division: Census Tract 101 includes Sunset Beach and Pupukea as well as Kahuku.

The recognized communities of the KNS region vary in ways rooted in their histories. Two – Kahuku and Waialua – once were the centers of sugar plantations. They retain remnants of mill infrastructure. They have public secondary schools. Their residents include retirees from the plantations, and the children and grandchildren of plantation workers. Lāʻie was acquired as a center for the Church of Jesus Christ of Latter-day Saints in 1865. It remains the center of Mormon worship and education in Hawaiʻi. Haleʻiwa and Sunset Beach have become famous as the home of North Shore surfing. They are mainly tourist and surf industry destinations, especially during the winter season, and are the base for major surfing contests.

Much of the SEIS site was once in sugar cultivation. Along Kawela Bay, cottages were placed above the beach area. During World War II, an airfield, revetments and barracks occupied most of the lands on the Kahuku side of the property. (See SEISPN Figure 13.)

The Turtle Bay Hotel opened in 1972. The two Kuilima Estates townhouse projects were built soon afterwards. The hotel provided a much-needed source of jobs, since the Kahuku Sugar plantation had just closed in 1971.

The Kuilima EIS process, in the mid-1980s, sought permits for development of a "critical mass" of hotels and vacation homes that would succeed as a separate resort destination as envisioned by the 1977 O`ahu General Plan. While permits were obtained and some initial work occurred, the new hotels were not built. In the intervening years, development has involved redevelopment of the Ocean Villas next to the hotel, a new 18-hole Palmer golf course and Fazio golf course renovations, and the construction of a new wastewater treatment plan mauka of Kamehameha Highway.

3.2 Socio-Economic Trends, 1980 to 2010

3.2.1 Population Characteristics

The KNS region has experienced population growth in every decade since 1980. However, that growth has been largely on the Koʻolau Loa side and in the Kawailoa area between Waimea and Haleʻiwa (Census Tract [CT] 100, labeled in Figure 3-1). The resident population of Haleʻiwa has declined, while the population of the Waialua area has been stable. For the entire KNS region, the result has been population growth at much the same rate as for the island as a whole over thirty years. (See Table 3-1.)

As Table 3-2 indicates, some characteristics of the population of the regional census tracts vary greatly. Lāʻie and Kawailoa stand out as having young populations. In Lāʻie, youths form a large part of the population. In Kawailoa, the young demographic is mostly over 18 years old. Throughout the region, the share of seniors in the population is lower than for Oʻahu as a whole.

The racial data in Table 3-2 reflects (a) broad Federal categories and (b) multiple claims to racial identity. Region-wide, White claims are more frequent, and Asian identification less frequent, than island-wide. The share of residents claiming Native Hawaiian or Pacific Islander status is much higher in Koʻolau Loa than island-wide. The Native Hawaiian or Pacific Islander share of the population is highest in the Hauʻula-Kaʻaʻawa and Lāʻie CTs. Claims to more than one racial

identity are higher in the former tract (CT 102.01). The share of the population identifying as Hispanic is higher in the three North Shore Census Tracts than the island average.

Schools assign a single ethnicity to each student for statistical purposes. The secondary school data in Table 3-3 show significant numbers of Native Hawaiians and Samoans at Kahuku High & Intermediate School (i.e., in Ko‘olau Loa). At Waialua High & Intermediate School, Filipinos form the largest recognized population. Only about a fifth of the population in either school is categorized as White.

Table 3-1: Population Trends, 1980 to 2010

	1980	1990	2000	2010
City and County of Honolulu	762,565	836,231	876,156	953,207
KNS Region	27,352	29,992	32,926	34,452
Ko‘olualoa District	14,195	18,443	18,899	21,406
CT 102.01 [Hauula-Kaaawa]	3,952	4,608	5,312	5,882
CT 102.02 [Laie]	5,752	6,926	6,100	7,643
CT 101 [Waimea-Kahuku}	4,491	6,909	7,487	7,881
Waialua District	13,157	11,549	14,027	13,046
CT 100 [Kawailoa]	1,879	1,801	4,338	3,320
CT 99.02 [Haleiwa]	5,350	3,956	3,958	3,740
CT 99.04 [Kaena Point]	5,928	5,792	5,731	5,986
	Average Annual Increase, over the decade ending in:			
		1990	2000	2010
City and County of Honolulu		0.9%	0.5%	0.8%
KNS Region		0.9%	0.9%	0.5%
Ko‘olualoa District		2.7%	0.2%	1.3%
CT 102.01 [Hauula-Kaaawa]		1.5%	1.4%	1.0%
CT 102.02 [Laie]		1.9%	-1.3%	2.3%
CT 101 [Waimea-Kahuku}		4.4%	0.8%	0.5%
Waialua District		-1.3%	2.0%	-0.7%
CT 100 [Kawailoa]		-0.4%	9.2%	-2.6%
CT 99.02 [Haleiwa]		-3.0%	0.0%	-0.6%
CT 99.04 [Kaena Point]		-0.2%	-0.1%	0.4%

SOURCE: U.S. Census, as reported in State Data Center reports and Data Books.

Table 3-2: Selected Population Characteristics, 2006 to 2010

	City and County of Honolulu	KNS Region	Census Tract 102.01 Hauula-Kaaawa	Census Tract 102.02 Laie	Census Tract 101 Waimea-Kahuku	Census Tract 100 Kawailoa	Census Tract 99.02 Haleiwa	Census Tract 99.04 Kaena Point
Population	936,984	32,700	5,286	6,940	7,408	3,179	3,729	6,158
Median Age	37.5	NA	32.0	23.8	33.3	24.5	37.5	39.0
Racial/Hispanic Identification (1)								
White	36.8%	56.2%	58.2%	46.1%	64.3%	77.5%	46.2%	51.4%
Black or African American	3.4%	2.6%	4.5%	0.5%	0.9%	8.4%	1.9%	3.0%
American Indian and Alaska Native	2.1%	4.4%	6.7%	2.1%	5.0%	7.9%	4.2%	2.9%
Asian	61.8%	37.7%	34.4%	25.1%	37.9%	20.8%	53.3%	53.8%
Native Hawaiian and Other Pacific Islander	23.1%	37.0%	55.0%	61.2%	30.3%	7.1%	27.9%	23.3%
Some Other Race	2.4%	1.5%	1.3%	0.7%	1.2%	4.0%	1.7%	1.7%
Hispanic	7.9%	9.3%	8.4%	4.5%	9.8%	13.6%	9.9%	12.1%
Persons below Poverty Level								
Share of Population	8.8%	10.4%	14.1%	10.0%	9.2%	19.5%	7.8%	6.2%
Population 16 and over	752,343	24,982	4,020	4,885	5,889	2,158	2,936	5,094
In Labor Force	501,779	17,106	2,580	3,382	3,935	1,516	2,217	3,476
In Civilian Labor Force	462,843	16,079	2,566	3,372	3,822	977	2,208	3,134
Civilian Labor Force Participation	61.5%	64.4%	63.8%	69.0%	64.9%	45.3%	75.2%	61.5%
Mean Travel Time to Work, Civilian Labor Force (minutes)	27.0	NA	37.4	17.9	35.1	23.7	27.4	32.2
Unemployment Rate, Civilian Labor Force	5.0%	6.5%	6.7%	3.5%	6.2%	9.8%	15.2%	5.1%
Households	304,827	9,135	1,546	1,225	2,297	1,034	1,091	1,942
Median Household Income	$70,093	NA	$66,500	$75,417	$64,623	$40,441	$74,719	$73,883
Population in households	902,832	31,111	5,236	5,978	7,277	3,096	3,729	5,795
Population in group quarters	34,152	1,589	50	962	131	83	-	363

NOTE:
(1) Based on "Race alone or in combination with other races" tally. Percentages add up to more than 100% since persons may claim more than one race.
SOURCE: U.S. Census, American Community Survey combined samples for 2006 through 2010, downloaded from American FactFinder at www.census.gov.

The difference between the racial data in Table 3-2 and in Table 3-3 is due in part to methodology and in part to the fact that many of the Whites in the region are young adults, not school-aged youth.

Table 3-3 also shows that very few students have limited English proficiency, while nearly half of the students in either school can qualify for free or reduced-priced lunch because of low family income. These indicators point to a low-income family population with a small number of immigrants from non-English-speaking lands.

Table 3-3: School Population Characteristics, 2011

	Kahuku	Waialua
Major recognized ethnicities (Percentage of student body)		
Filipino	6.1%	35.8%
Native Hawaiian	40.0%	27.3%
Samoan	13.5%	1.6%
White	20.7%	19.5%
Students with Limited English Proficiency	3.6%	6.2%
Students qualifying for Free or Reduced Price Lunch	49.2%	45.0%

SOURCE: School Status and Improvement Reports, 2011, for Kahuku High and Intermediate School and for Waialua High and Intermediate School, posted at http://doe.k12.hi.us/.

The group-quarters population in Lāʻie consists of students at Brigham Young University – Hawaii (BYUH) in dormitories. The persons in group-quarters in the Kaena Point tract (CT 99.04) are largely military (at Helemano). Both nursing homes and other, not categorized, facilities house the group-quarters population of CT 101.

3.2.2 Housing Characteristics

The region has seen growth in both households and housing units since 1980 (as shown in Table 3-4). Much of the housing is dedicated to vacation or part time resident housing due to the surfing and other recreational attractions of the area. (The large majority of the "vacant" units counted by the various Censuses in the region are second homes or vacation rentals.) Rentals form a larger share of the housing stock than in the rest of Oʻahu, especially in the Kawailoa Census Tract (as shown in Table 3-5). This is due in part to the area's appeal to surfers, many of whom rent for longer periods than other vacationers.

Limited availability of affordable housing for local working families has been a concern for decades in the region (and island-wide). Key reasons include limited availability of zoned residential land, and the high cost of land and construction. General housing trends for the area include an increase in the total number of units in both districts of the KNS region since 1980, with a decline in the Waialua district after 2000. The number of occupied housing units grew throughout the period in the Koʻolau Loa District, but only through 2000 in Waialua District. Housing has increased at a faster rate than the resident population in the region, but increased housing prices have made most new homes too expensive for working families. This phenomenon is understandable in light of the North Shore's appeal as a surfing destination with broad expanses of beaches that are attractive year round.

Vacation rentals affect the availability of housing for residents. The City and County of Honolulu recognizes some 70 units with Non-Conforming Use Certificates in Koʻolau Loa and 10 in the North Shore. These are vacation rentals or bed-and-breakfast establishments that have received legal transient accommodation permits. Many more units are rented illegally. One resident has estimated that the Haleʻiwa or North Shore area includes 450 illegal rentals.[6]

[6] Outside of resort districts, housing can be rented for six months or more at a time. Shorter rentals – "transient vacation rentals" – are sources of income for some homeowners, but may be irritants for others in their neighborhoods. Only long-standing transient vacation rentals can be recognized as legal so long as the use continues from before current zoning rules were enacted. The count of recognized Non-Conforming Uses is from http://honoluludpp.org/HotIssues/NUCreport.pdf. The resident cited in the text is B. Ready, "Illegal Vacation Rentals behind Opposition to Haleiwa Inn?" *Hawaiʻi Free Press.* June 26, 2012. Posted at http: www.hawaiifreepress.com/ArticlesMain/Tabid/56/ArticleType/CategoryView/categoryID/47/Oahu-News.aspx.

Table 3-4: Housing and Occupancy, 1980 to 2010

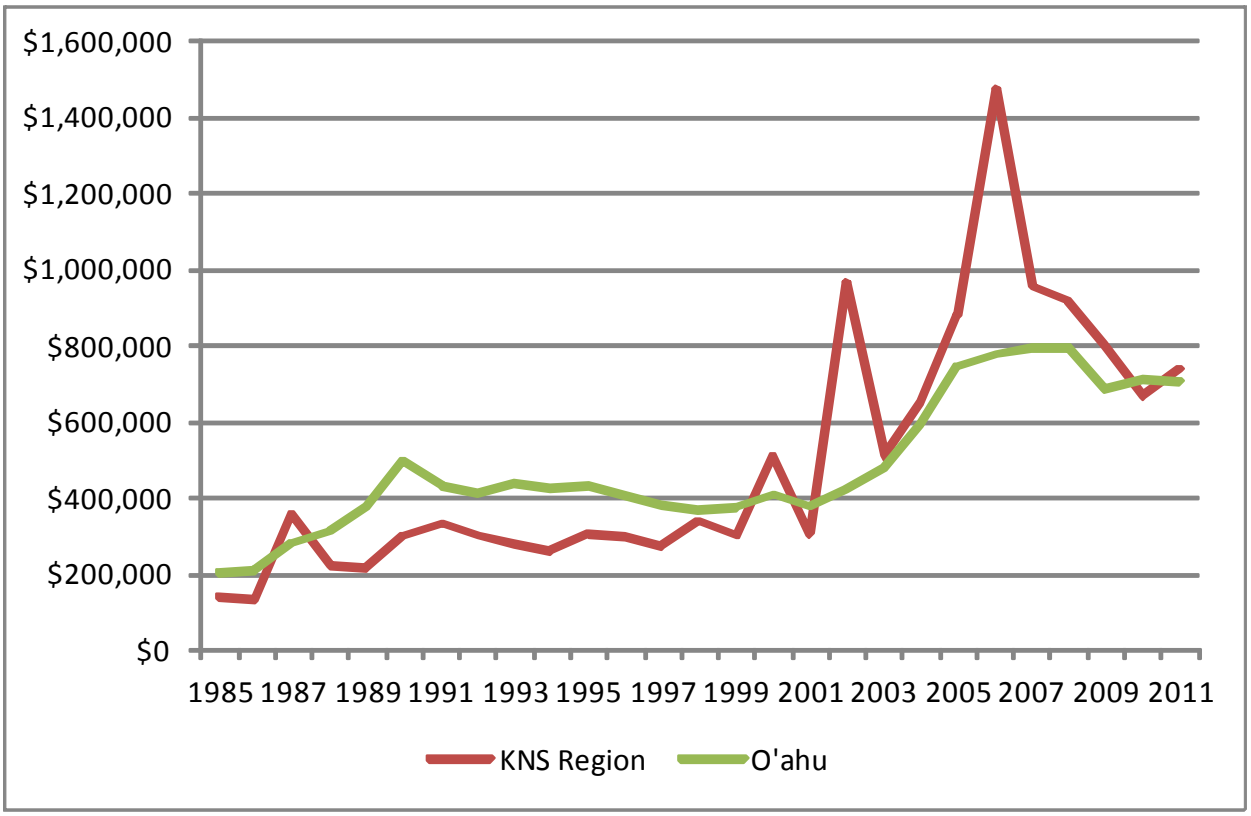
	1980	1990	2000	2010
Total Housing Units				
City and County of Honolulu	250,864	281,683	315,988	336,899
KNS Region	7,877	9,709	11,121	11,562
Koʻolualoa District	4,679	5,939	6,199	6,808
CT 102.01 [Hauula-Kaaawa]		1,826	1,932	2,098
CT 102.02 [Laie]		1,517	1,452	1,560
CT 101 [Waimea-Kahuku}		2,596	2,815	3,150
Waialua District	3,198	3,770	4,922	4,754
CT 100 [Kawailoa]		559	1,517	1,309
CT 99.02 [Haleiwa]		1,187	1,247	1,231
CT 99.04 [Kaena Point]		2,024	2,158	2,214
Occupied Housing Units (Households)				
City and County of Honolulu	230,214	265,304	286,450	311,047
KNS Region	6,586	8,403	9,575	9,675
Koʻolualoa District	3,742	4,935	5,172	5,483
CT 102.01 [Hauula-Kaaawa]	1,166	1,458	1,571	1,684
CT 102.02 [Laie]	1,080	1,350	1,274	1,342
CT 101 [Waimea-Kahuku}	1,496	2,127	2,327	2,457
Waialua District	2,844	3,468	4,403	4,192
CT 100 [Kawailoa]	478	491	1,375	1,163
CT 99.02 [Haleiwa]	753	1,113	1,145	1,112
CT 99.04 [Kaena Point]	1,613	1,864	1,883	1,917
Vacant Units as Share of Total Units				
City and County of Honolulu	8.2%	5.8%	9.3%	7.7%
KNS Region	16.4%	13.5%	13.9%	16.3%
Koʻolualoa District	20.0%	16.9%	16.6%	19.5%
CT 102.01 [Hauula-Kaaawa]		20.2%	18.7%	19.7%
CT 102.02 [Laie]		11.0%	12.3%	14.0%
CT 101 [Waimea-Kahuku}		18.1%	17.3%	22.0%
Waialua District	11.1%	8.0%	10.5%	11.8%
CT 100 [Kawailoa]		12.2%	9.4%	11.2%
CT 99.02 [Haleiwa]		6.2%	8.2%	9.7%
CT 99.04 [Kaena Point]		7.9%	12.7%	13.4%

SOURCES: Kuilima EIS, Appendix J and American FactFinder (www.census.gov).

In the period from 1985 through 2010, a total of 1,077 new single family homes were built in the KNS region.[7] On average, some 18 houses were built each year in the area from Ka‘a‘awa through Kahuku, 12 in the area from Turtle Bay through Waimea Bay, and 11 in the remaining North Shore area.

Average single family housing prices in that time increased faster in the KNS region than island-wide, as shown in Figure 3-2. The increase in average single family prices since 2000 is consistent with rapid growth of a non-resident market in the region. At the peak of the recent high sales period, KNS single family sales averaged 189% of island-wide sales. (In 2006, the regional average was $1,472,726, and the island average was $778,393. Since then, the regional average has returned to levels close to the island average.)

Figure 3-2: Average Annual Sales Prices, Single Family Homes, KNS Area and O‘ahu



NOTE: Average (mean) prices are used rather than medians in order to compare data from different sources. For small areas, average prices can be affected significantly by outliers, i.e., a few extreme cases. This obviously occurred in 2002 and 2006. Still, the overall trend is that the KNS average, once below the island average price, now tends to exceed the island average.
SOURCES: Honolulu Board of Realtors; download from Hawaii Information Service.

[7] Hawaii Information Service download, analyzed by Belt Collins Hawaii. Only single family units were analyzed because information about the year condominium units were built was not consistently available.

Table 3-5: Households and Household Size, 2010

	City and County of Honolulu	KNS Region	Census Tract 102.01 Hauula-Kaaawa	Census Tract 102.02 Laie	Census Tract 101 Waimea-Kahuku	Census Tract 100 Kawailoa	Census Tract 99.02 Haleiwa	Census Tract 99.04 Kaena Point
Population in Households	917,907	31,656	5,531	5,776	7,848	3,170	3,683	5,648
Households	311,047	9,675	1,684	1,342	2,457	1,163	1,112	1,917
Owner-occupied	56.1%	47.0%	50.8%	44.7%	52.3%	18.9%	53.5%	51.5%
Rented	43.9%	53.0%	49.2%	55.3%	47.7%	81.1%	46.5%	48.5%
Average household size								
All households	2.95	3.27	3.28	4.30	3.19	2.73	3.31	2.95
Owner-occupied	3.11		3.59	4.60	3.58	2.79	3.64	3.15
Rented	2.75		2.97	4.06	2.78	2.71	2.94	2.73

SOURCE: U.S. Census, 2010 Census. Download from www.census.gov.

In most of the region, about half of the occupied households are owner-occupied, except in CT 100. (See Table 3-5.) Household sizes for owner-occupied households are larger than the island average (again, except in CT 100), with households in Lāʻie appreciably larger than elsewhere. Renters in Lāʻie also have large households. In other tracts in the region, average renter household sizes are close to the island average.

The Kawela Bay Census Designated Place (CDP) includes the Turtle Bay Resort and some neighboring residential sites. In 2010, it was home to 330 persons in 153 households: the average household size was 2.16 persons per household. Owners lived in 87 (56.9 %) of these units; renters occupied the remaining 66 units. The CDP included a total of 518 housing units, so the occupied units accounted for only 29.5 percent of the housing stock.[8]

By 2012, the Honolulu Real Property Tax files recognized 366 parcels with taxable housing units within Kuilima Estates[9]. Of these, some 52 (14.2 %) were listed as owner-occupied. This share is slightly lower than the share counted by the Census in 2010 for the CDP as a whole (87 of 518 units, or 16.8%).[10]

The TMK database shows that less than half of dwellings in the region are registered as owner-occupied for tax purposes, and the share of all housing units registered as owner-occupied is especially low in the region between Turtle Bay and Waimea Bay. In other words, rentals, second homes and vacation units are more prevalent in this area than elsewhere in the region.[11]

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[8] US Census, Summary File 1. Data posted at http://hawaii.gov/dbedt/info/census/Census_2010/SF1/DEC_10_SF1_GCT_CDP.xls.

[9] There are 368 total units in the Kuilima Estates, but two of them are management units.

[10] Information for TMK 1-5-7:27 and 1-5-7:29, downloaded from Hawaii Information Service in June 2012.

[11] The count of single-family dwellings in the TMK database is much smaller than the housing units counted in the 2010 Census. As a result, only the general statement of findings noted in the text seems warranted.

Illegal rentals are also said to be common. All of these uses for housing, which tend to limit the supply affordable for residents, are consistent with the North Shore's appeal as a surfing and beach destination.

3.2.3 Economic Characteristics of the Resident Population

Table 3-6 shows basic data on residents' economic situation captured by the American Community Survey (ACS) for 2006 to 2010. (The ACS data consist of samples collected in each of five years, and cannot be treated as occurring in any single year. It is the most recent data available at the CT level.)[12]

Two indicators of prosperity tell distinct stories. On the one hand, the median household income is about the same as island-wide in all of the KNS Census Tracts except Kawailoa (CT 100). On the other hand, the share of the population with incomes below the poverty level was elevated in both the Hauʻula-Kaʻaʻawa and Kawailoa CTs.

Labor force participation was low in the Kawailoa CT, but equal to or higher than the island average in the rest of the region. Unemployment in Kawailoa and Haleʻiwa was high compared to the island average.[13] Lāʻie, with some of the region's major employment centers, had very low unemployment.

[12] This section deals with the economic situation of KNS residents; Section 3.3.8 discusses the situation of the various industries in the region.

[13] Census unemployment rates are based on different definitions than the rates commonly reported. Also, since ACS data are drawn over a five-year period, the ACS rates cannot be compared to other unemployment rates for any given date or year.

Table 3-6: Selected Economic Characteristics, 2006-2010 ACS

	City and County of Honolulu	KNS Region	Census Tract 102.01 Hauula-Kaaawa	Census Tract 102.02 Laie	Census Tract 101 Waimea-Kahuku	Census Tract 100 Kawailoa	Census Tract 99.02 Haleiwa	Census Tract 99.04 Kaena Point
Population	936,984	32,700	5,286	6,940	7,408	3,179	3,729	6,158
Median Age	37.5	NA	32.0	23.8	33.3	24.5	37.5	39.0
Persons below Poverty Level Share of Population	8.8%	10.4%	14.1%	10.0%	9.2%	19.5%	7.8%	6.2%
Population 16 and over	752,343	24,982	4,020	4,885	5,889	2,158	2,936	5,094
In Labor Force	501,779	17,106	2,580	3,382	3,935	1,516	2,217	3,476
In Civilian Labor Force	462,843	16,079	2,566	3,372	3,822	977	2,208	3,134
Civilian Labor Force Participation	61.5%	64.4%	63.8%	69.0%	64.9%	45.3%	75.2%	61.5%
Mean Travel Time to Work, Civilian Labor Force (minutes)	27.0	NA	37.4	17.9	35.1	23.7	27.4	32.2
Unemployment Rate, Civilian Labor Force	5.0%	6.5%	6.7%	3.5%	6.2%	9.8%	15.2%	5.1%
Households	304,827	9,135	1,546	1,225	2,297	1,034	1,091	1,942
Median Household Income	$70,093	NA	$66,500	$75,417	$64,623	$40,441	$74,719	$73,883

SOURCE: American Community Survey, 2006 to 2010, downloaded from American FactFinder at www.census.gov.

About 80% of the Turtle Bay Resort workforce lives in the KNS Region. While more than a hundred live in Kahuku, resort employees are found throughout the region.

3.2.4 Public Facilities and Natural Resources

Public Safety: Police

The KNS region is within two police districts, with stations in Kāneʻohe and Wahiawā, outside the region. A substation in Kahuku, about five (5) miles from the resort, serves the Koʻolau Loa side of the region. Island-wide, recruitment is adequate to keep police staffing constant, but not to expand to fill vacancies. The Kahuku substation is authorized to have five officers but has only three or four at a time.

Public Safety: Fire

Fire stations are located in the KNS region at Kaʻaʻawa, Hauʻula, Kahuku, Sunset Beach, and Waialua. The Kahuku station is about five (5) miles from the resort. The Fire Department plans to relocate the Hauʻula and Waialua stations to sites outside of the flood plain.

Medical Facilities

Kahuku Medical Center is the only hospital in the region. It is approximately four (4) miles from the resort. It provides 24-hour emergency care. It is part of the Hawaii Health Systems Corporation, a state organization providing primary care in underserved areas. Koʻolauloa Community Health and Wellness Center, a federally qualified health center, has a clinic in

Hau‘ula and offices at the Kahuku Medical Center. Wahiawa General Hospital, in Central O‘ahu, also serves North Shore patients, while Castle Medical Center in Kailua serves some Ko‘olau Loa patients. Honolulu hospitals provide specialty services and care.

In the Kahuku area, Kahuku Medical Center has 31 beds, and Crawford's Convalescent Home has 55. Kahuku Medical Center's occupancy varied by bed type: surgical care (11 beds, 5% occupancy in 2009), acute/specialized nursing care (11 beds, 55% occupancy), and intensive care (10 beds, 98% occupancy).[14]

On the Behavioral Risk Factor Surveillance survey, KNS respondents usually report high levels of health care coverage, although an indicator of usage ("Visited doctor for a routine checkup during the past year") shows mixed results from 2005 through 2010.[15]

Schools

Two high schools catchment areas cover the region. Table 3-7 lists these and their current enrollment.

Table 3-7: Enrollment in KNS Public Schools, September 2011

	Enrollment
Leilehua-Mililani-Waialua Complex Area	
Waialua High and Intermediate School	642
Haleiwa Elementary School	180
Waialua Elementary School	506
Castle-Kahuku Complex Area	
Kahuku High and Intermediate School	1,491
Hauula Elementary School	267
Kaaawa Elementary School	141
Kahuku Elementary School	490
Laie Elementary School	658
Sunset Beach Elementary School	451
Total Enrollment, KNS public schools	*4,826*

SOURCE: Hawaii Department of Education website.

St. Michael's School in Waialua and Sunset Beach Christian both provide private elementary education. Plans for a high school near Hale‘iwa, Aloha Ke Akua, have been advanced, but the initiative appears to have stalled for lack of financial support.

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[14] Occupancy estimates for 2009 from Hawaii State Department of Health, posted at http://hawaii.gov/shpda/resources-publications/health-care-utilization-reports/updates-and-results/2009-data/table-6. The figures for acute and long-term care are below the county averages for that year.

[15] Hawaii State Department of Health website, http://hawaii.gov/health/statistics/brfss/HBRFSS-IA9/atlas.html accessed April 26, 2012.

A new school based in Hau‘ula, Hawaii Active Learning Academy, combines on-line classes with projects led by teachers. Its application for charter school status was denied in 2011. It functions now as a private school.

Kahuku High School graduated 250 students in 2009, while Waialua High School graduated 98.[16] Over 80 percent of graduating students from Kahuku have planned to continue schooling, but most planned to combine school and work.[17]

Preschools

Early child-care facilities in Hawai‘i are licensed or, if small, license-exempt. Ten licensed programs are located in the KNS region: four Head Start programs, two programs associated with local churches, two non-denominational private programs, a Hawaiian language preschool and a preschool run by a charity serving low-income families. All run day programs only.

In recent years, preschools in the region have not operated at capacity (personal communication, Steve Albert, Rainbow Schools, October 2011). With the economic downturn, state funds to support preschools were cut and family budgets tightened.

Recreation Facilities

The North Shore’s beaches and harbors support surfing, boating activities, swimming and, in calm weather, snorkeling and scuba diving. The region is host to the Triple Crown of Surfing competition and the Quiksilver in Memory of Eddie Aikau surfing competition held at Waimea Bay only when waves are consistently over 20 feet (measured from behind the wave). The North Shore surf attracts tourists, whether as beachgoers or observers, throughout the year, but especially during the winter season.

In 2010, some 1.5 million beachgoers were counted by Water Safety Officers at guarded beaches in the KNS region, 9.6% of the total O‘ahu beach count.[18] Some 17% of the surfing accidents and rescues reported island-wide were at KNS beaches.

These counts do not cover the Turtle Bay Resort beaches. Kawela Bay is currently used by a few people for beach going, fishing and water sports (as documented in the SEIS Appendix on Marine Resource Impacts).

In recent years, turtle and seal populations have increased in Hawai‘i. Turtles are sighted regularly by visitors along the KNS coastline. A marine resources impact analysis conducted for the SEIS documents an increase in turtle and seal populations at Kawela Bay since 1985.

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[16] Hawaii State Department of Education report posted at http://doe.k12.hi.us/reports/highschoolcompleter0809.pdf

[17] Based on School Exit Plans Survey, last conducted in spring 2008, for Kahuku High School, http://arch.k12.hi.us/PDFs/resources/archive/seps/2008/SEPS307.pdf.

[18] KNS guarded beaches are Hale‘iwa Ali‘i, ‘Ehukai, KeWaena, Sunset and Waimea. Other popular beaches are found throughout the region. DBEDT, *2010 State of Hawaii Data Book*, Table 7.51.

Laniākea Beach (also known as Turtle Beach), approximately nine miles west of Turtle Bay Resort, has become an extremely popular destination for tour buses and free-and-independent (F.I.T.) visitors to view turtles basking on the shore and swimming in the near shore area.

The KNS region has a wide range of recreation sites. Beach parks are dotted along the entire coast, notably near famous surf breaks. District parks at Kahuku and Waialua include sports fields. (Kahuku District Park, about three miles from the resort, has baseball and softball fields, and a volleyball court.) Malaekahana State Recreation Area supports camping by the beach. The Friends of Malaekahana provide patrolled camping sites, yurts, and other overnight shelters for rent. Within Koʻolau Loa, the Ahupuaʻa o Kahana State Park is an entire valley dedicated as a cultural park, with marked trails for walkers. Waimea Valley, on the North Shore, has extensive horticultural plantings and cultural exhibits. It is operated as a visitor attraction. Dillingham Airfield has glider rides.

In addition to the golf courses at Turtle Bay, Kahuku has a nine-hole public course.

The Polynesian Cultural Center is a visitor destination, with "villages" representing several island societies, *luʻau* dinners, and an evening show. The PCC reported 692,081 visitors in 2010.[19] Just south of the KNS region, Kualoa Ranch offers a range of outdoor activities for visitors, including horse rides and all-terrain vehicle tours.

3.2.5 Social Trends

Community Decision-Making and Cohesion

While all of Oʻahu is a single political entity, the City and County of Honolulu, smaller areas have representatives on the City Council and in the State Legislature. Local decision-making and advisory bodies that express and shape local views include two Neighborhood Boards. Neighborhood Board No. 28 (Koʻolau Loa) covers the Koʻolau Loa SCP area (i.e., Kaʻaʻawa to Kawela), and Neighborhood Board No. 27 (North Shore) serves communities from Sunset Beach to Kaʻena Point. The Neighborhood Boards are elected, meet regularly, and post minutes (at http://www1.honolulu.gov/nco/boards.htm). Board members on Oʻahu often are recognized local stakeholders, and many go on to serve in political offices. The Boards' role is defined as advisory, but they are regularly asked to comment on development proposals. They provide an arena for local issues and debates.

Community Advisory Committees were formed in support of updates for the North Shore and Koʻolau Loa Sustainable Communities Plans. Members carefully reviewed both the existing SCPs and proposals for development or new regulatory frameworks in each area. The North Shore revised SCP was adopted in 2011. A Public Review Draft of the Koʻolau Loa SCP was published and reviewed in the region in 2010. The City and County Department of Planning and Permitting (DPP) is responsible for finalizing the SCP and forwarding it to the City Planning Commission and City Council.

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[19] DBEDT, *2010 State of Hawaiʻi Data Book*, Table 7.43.

The Public Review Draft of the Koʻolau Loa Plan includes support for small-scale visitor facilities in keeping with the area's "country" character. The draft reflects community concerns about traffic and stress on local infrastructure with regard to expansion of the Turtle Bay Resort, while expressing support for existing operations. The draft can be taken as reflecting the views of a range of local leaders, but its contents are determined by DPP.

The North Shore Chamber of Commerce has grown from Haleʻiwa Main Street to represent local commercial interests throughout the KNS region. It arranges events such as the annual Arts Festival.

Other local groups include community associations, which vary greatly in their level of activity. The Waialua Community Association was incorporated in 1937. It built the WCA gymnasium in Haleʻiwa and continues to operate this facility, serving the entire North Shore. A separate group, Friends of Waialua, sponsored a master plan for the Waialua Town Center (developed with City and County funding). The Lāʻie Community Association has participated extensively in the Envision Lāʻie process, supporting expansion of BYUH and the building of a larger hotel to replace the Laie Inn. (The Kahuku Community Association has written to the City and County in support of the Envision Lāʻie process.) Other community associations deal with issues of concern in the towns along the coast. Local institutions may have active groups of associates and supporters. Waimea Valley has provided a venue for Hawaiian cultural practitioners in the region. Kahuku High & Intermediate School has active community support, most visibly for its winning football team.

Concerns about development have been voiced by groups of local stakeholders. Keep the North Shore Country was a plaintiff, along with the Sierra Club, in the suit challenging the Kuilima EIS as outdated. It is part of the Koʻolau Loa/North Shore Alliance and works with the Defend Oʻahu Coalition to oppose development at Turtle Bay and in Lāʻie.

The Kuilima/North Shore Strategic Planning Committee was formed in the 1980s to identify ways in which redevelopment of the resort could benefit regional residents. It was involved in planning for community benefits after the Kuilima EIS was approved. It continues to meet and provide community input to redevelopment planning for the Turtle Bay Resort.

Quality of Life

Residents of the KNS region are proud of their communities. The North Shore is renowned for its surf and surfing lifestyle. Koʻolau Loa is less well known. Both areas are viewed as "country" by Oʻahu residents, and many agree that they should be protected from urbanization.

These "country" areas are far from isolated. Many workers commute daily outside the region. The North Shore exports surfboards and agricultural products worldwide. Retail and recreational businesses in Haleʻiwa cater to tourists traveling around the island. During the winter surf season, local traffic is even more congested than usual because of the influx of spectators to surfing competitions. Koʻolau Loa includes both major visitor facilities (the PCC and Turtle Bay) and institutions central to Hawaiʻi's Mormon community. BYUH has attracted students and residents from the island communities of Polynesia as well as Hawaiʻi.

Few useful generalizations about quality of life can be made for the entire region. Persons, families and communities vary over time as they encounter challenges or enjoy prosperity and wellbeing. A few indicators may help to suggest ways that the region's reputation, economy and community life inform residents' lives:

- Unemployment is higher in the KNS region than the island average, and average wages (as distinct from household income as a whole) are lower;

- Surveys of students, parents and teachers indicate that family ties and family involvement in schools are strong in the Kahuku High School catchment area (i.e., mainly Koʻolau Loa). Young people report that they have close neighborhood ties. When data from schools throughout Hawaiʻi were compiled, the Kahuku community was ranked ninth of 42 communities in "protective factors" tending to support young people's success in life.[20]

  Responses from the Waialua High School area are closer to the island and state average. The summary report suggests some of the strengths of the area:

  > In a Statewide survey of students, more than half of the adolescents responding in the Waialua Area reported problems in family relationships. However, most of the adolescents reported strong neighborhood ties and that their schoolwork was interesting and meaningful. The graduation rate in this community is high, and most high school seniors plan to attend college.[21]

- Respondents to the Behavioral Risk Factor Surveillance Survey from the KNS region were more likely than ones from any other community in Hawaiʻi to report their general health status as good to excellent. They also ranked highest as experiencing social and emotional support. On the other hand, the community also ranked high in reports of high blood pressure.[22]

Emerging Regional Trends

Long-term projections are for slow population growth (at a rate of about 0.5 percent annually) and slightly faster job growth for the KNS region, as shown in Table 3-8. The City and County's Department of Planning and Permitting developed these projections based on a State forecast issued in 2009. The projections were based on information available to the Department about permitted development, including the new development permitted at Turtle Bay Resort, as allowed under the Full Build-Out alternative. Figure 3-3 shows the areas as defined by DPP.

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[20] Center on the Family, University of Hawaiʻi, *Kahuku Area Community Profile*. Honolulu, HI: 2003

[21] Center on the Family, University of Hawaiʻi, *Waialua Area Community Profile*. Honolulu, HI: 2003. Waialua ranked 21st of 42 on the scale mentioned above, with protective factors slightly outweighing risk factors.

[22] Hawaiʻi State Department of Health, interactive database with data for 2005 to 2010, posted at http://hawaii.gov/health/statistics/brfss/HBRFSS-IA9/atlas.html. The region's respondents had less extreme results for asthma and other health problems.

Table 3-8: Population and Employment Projections, KNS Region, to 2035

	Total Population			Civilian Employment		
	2010 est.	2025	2035	2010 est.	2025	2035
Ka‘a‘awa	1,399	1,393	1,379	147	80	89
Hauula/Punaluu	3,717	3,864	3,893	600	648	673
Lā‘ie	5,902	6,394	6,557	3,147	3,318	3,359
Kahuku/Kawela	3,138	3,499	3,623	1,734	2,522	2,723
Sunset Beach/Pupukea	4,240	5,643	6,177	995	1,082	1,068
Kawailoa	3,779	3,732	3,674	227	238	239
Hale‘iwa	4,198	4,350	4,365	1,765	1,796	1,807
Waialua	3,249	3,157	3,085	384	390	391
Mokulē‘ia	2,258	2,244	2,216	392	403	405
KNS Region	31,880	34,276	34,969	9,391	10,477	10,754
KNS 2010 Census	32,700			NA		
Increase over 2010 Census		1,576	2,269			

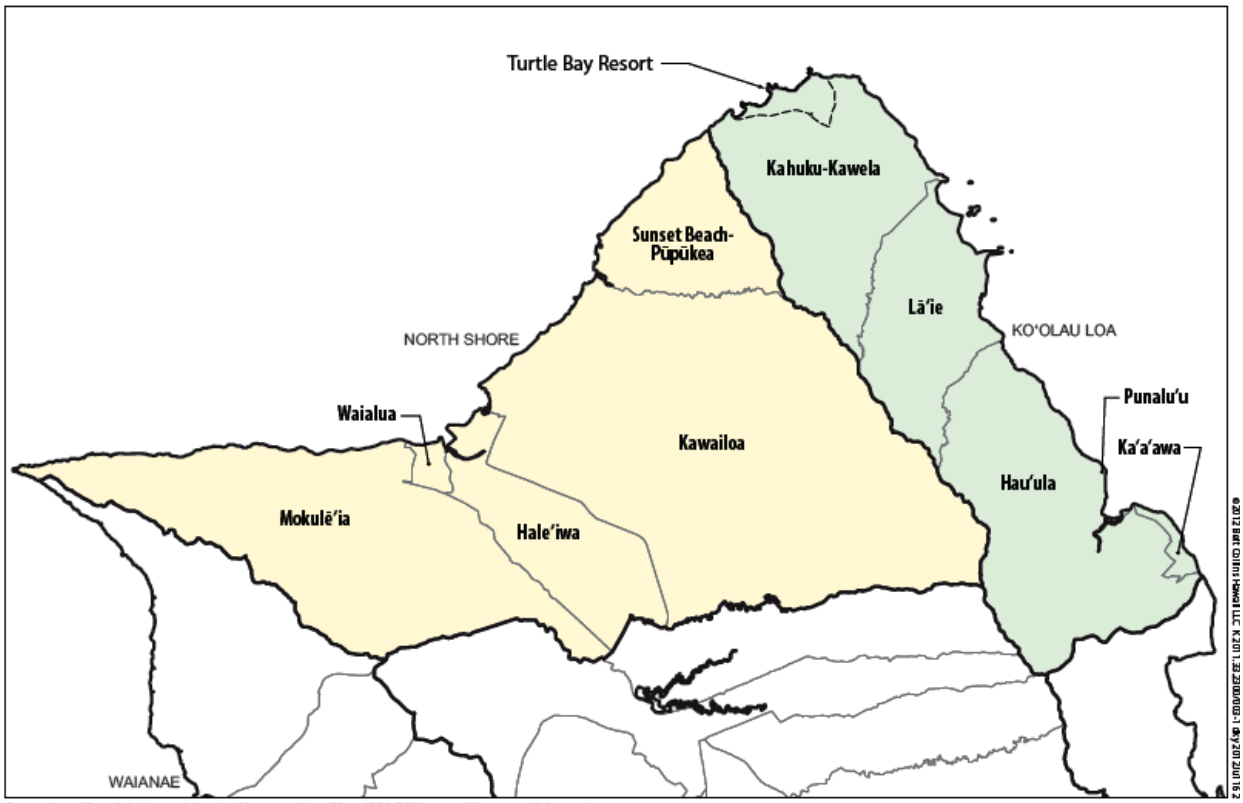
NOTE: The Census deals with employed residents; the projections deal with jobs in the region. In 2010, some 16,079 persons living in the KNS region were in the civilian labor force. Civilian employed residents of the region numbered about 1.6 times the number of jobs in the region.

SOURCE: City and County of Honolulu, Department of Planning and Permitting, posted at http://honoluludpp.org/planning/demographics2/Projections/2000-2035byDPSA.pdf

Recently, the State forecast has been updated. For the civilian population of the City and County as a whole, population growth now is projected as slightly slower.[23] While the projected total island population in 2025 and 2035 is higher in the new projection, the difference is due to the increase that has already occurred on O‘ahu, not to future growth.

[23] In the new projection, DBEDT expects the military and military dependent population on O‘ahu to shrink slightly (http://hawaii.gov/dbedt/info/economic/data_reports/2040-long-range-forecast).

Figure 3-3: Sub-Areas in the KNS Region



Source: *http://honoluludpp.org/planning/demographics2/Maps/DPA-DPSAmap.pdf* (accessed July 2012).

BELT COLLINS

NORTH

0 1 2 3
SCALE IN MILES

Figure 3-3
KO'OLAU LOA-NORTH SHORE REGION SUBAREAS
Socio-Economic Impact Assessment, Turtle Bay Resort
July 2012

3.2.6 Community Issues and Concerns

Sources

For this analysis, Belt Collins Hawaii (BCH) has drawn on public records of those discussions and planning documents produced with community input, and on a series of interviews with key stakeholders. Most of the interviews were conducted in October through December 2011. Table 3-9 lists the interviewees who shared their views and those of others in their communities.

Throughout the interview process, BCH staff sought to learn stakeholders' ideas and concerns, not to convince them or to poll them on a single issue. The process did not yield quantitative findings that can be attributed to the regional population or even any stakeholder group. Instead, it served to identify the range of issues and concerns that shape attitudes towards the Proposed Action and Alternatives. Interviewees were asked whether they thought the various alternatives would have greater or lesser, or different, impacts than the Proposed Action. The aim was to learn more about anticipated impacts, not to find which alternatives had more support.

Table 3-9: Persons Interviewed for This Report

First	Last	Affiliation Notes
Kat	Adcox	Kuilima Estates resident
		Waimea Valley employee
Steve	Albert	Rainbow School
Eric	Beaver	President, Hawaii Reserves, Inc. Past Chairman, Kahuku Hospital
Tinker	Bloomfield	Pupukea resident; Waimea Valley employee
Clifton C.	Cassity	Managing Agent, Villa Management at Turtle Bay Resort
Mona	Chang-Vierra	Waimea Valley
Mitch	Costino	Kuilima Estates West Association - President
Tom	Cross	Turtle Bay Resort, Resort Manager
Joann	Dicion	Turtle Bay Resort employee
Kent	Fonoimoana	Koʻolauloa Neighborhood Board; Defend Oahu Coalition
Danna	Holck	Turtle Bay Resort, General Manager
Randal	Hoopai	Waimea Valley Facilities Manager; Waimea resident
Elaine	Hornal	Turtle Bay Resort employee
Patsy	Izumo	Waimea Valley
Choon	James	Marconi Road resident
Jeff	Johnston	Turtle Bay Resort employee

Continued on next page

Table 3-9, continued

First	Last	Affiliation Notes
Barbara	Kahana	Koʻolaulea Neighborhood Board
Kent	Kamiya	Kamiya Papaya Farm
Dee Ann	Kekahuna	Waimea Valley Human Resource Manager; Kahuku resident
Daniel	Kerwin	Unite Here! Local 5 Hawaii, Organizer
Bob	Leinau	North Shore Neighborhood Board
DeeDee	Letts	Koʻolauloa Neighborhood Board; Koʻolauloa North Shore Alliance; Specialty Courts Coordinator; Mutual Housing Board - President
Melvin	Matsuda	Kahuku Brand Farms
Susan	Matsushima	Alluvion Inc, CEO (North Shore)
Creighton	Mattoon	Koʻolauloa Neighborhood Board: Kahuku Medical Center Board of Directors, Vice President; Koʻolauloa North Shore Alliance; Punaluʻu Community Association; Koʻolauloa Hawaiian Civic Club; Keep the Country Country
Cathleen	Mattoon	Koʻolauloa Hawaiian Civic Club; Punaluʻu Community Association
Lt Tasman	McKee	Honolulu Police Department
Elena	Meehan	Turtle Bay Resort employee
Antya	Miller	North Shore Neighborhood Board; North Shore Chamber of Commerce; Haleiwa Main Street; Wailua Community Association
Bob	Nakata	Former State Representative; Former State Senator; Kahaluu United Methodist Church, Sr. Pastor; Kahalu'u resident
Josanda	Napeahi	Turtle Bay Resort employee
Jay	Oku	North Shore Disaster Preparedness Committee
Kathleen	Pahinui	North Shore Neighborhood Board; Wailua Community Association
Junior	Primacio	North Shore Strategy Planning Committee; Former Koolualoa NB, No 28; General Manager of former Kahuku Housing Corporation
Ben	Shafer	Kahana Valley resident
Captain D.	Tsuchida	Honolulu Police Department
Bernadette	Tyrell	Principal, Sunset Elementary School
Stephanie	Vaioleti	Administrative Director, Kahuku Medical Center; Board Member, Koolauloa Educational Alliance Corp
Jeff	Wallace	Honolulu Fire Department; Caretaker for Continental Properties on Marconi Road
Ronald	Weidenbach	Hawaii Fish Company
Sadia	Wilkins	Turtle Bay Resort employee
Harvey	Wong	Turtle Bay Resort employee
Anonymous (three persons)		Kuilima Estates residents

NOTE: Affiliations are given to suggest how particular stakeholders helped Belt Collins Hawaii understand issues and concerns in the region. When an organization or agency is mentioned, no claim is made here that it supports the Proposed Action, or that it has made any official response to the Turtle Bay Resort redevelopment. BCH interviewers sought to elicit interviewees' knowledge and perspectives, not their support or opposition to the Proposed Action.

Many of the stakeholders interviewed have already expressed strong views about the Proposed Action or earlier plans for expansion. Several are members of organizations that have challenged expansion plans in court and in community discussions. BCH sought to learn from a wide range of knowledgeable members of the KNS population, not just those with a particular stand on the Proposed Action.

Issues and Concerns Independent of Project

For this report, BCH reviewed the minutes of the two Neighborhood Boards in the region for 2010 through early 2012 to learn of current concerns. Recurring themes that arose in the discussions included:

- Congested roadways: On the North Shore, this issue largely involves tourist traffic and visitors parking near beach sites, especially Laniākea. In Koʻolau Loa, residents were concerned about roadways where resident parking obstructed traffic, and about possible future expansion of the highway that could affect abutting properties.

- Concern about proposed development and redevelopment: Many residents in both areas expressed opposition to new development projects, including Envision Lāʻie, the expansion of Turtle Bay Resort and the proposed Haleʻiwa hotel. The Kamehameha Schools' project to renovate commercial areas in Haleʻiwa was viewed critically as affecting existing businesses, while the proposed move of the Hauʻula fire station was seen as taking limited Commercially-zoned land out of private hands.

- Appreciation for developers who listen to local stakeholders: While community members expressed concern about wind farm development at Kahuku and Kawailoa, they also expressed appreciation for the involvement of First Wind, the developer of both the currently operating Kahuku wind farm and the Kawailoa wind farm, now under construction. Similarly, community stakeholders have welcomed the open attitude of TBR in introducing and sharing information about the Proposed Action and the SEIS process.

- Members of both boards support agriculture and preservation of land for agriculture.

- Outside agencies may make decisions that ignore local views and concerns. Discussion of the Koʻolau Loa Sustainable Communities Plan has recently focused on the fact that the Public Review Draft, issued by the City Department of Planning and Permitting (DPP), supports the Envision Lāʻie plans, while the earlier draft vetted by an advisory committee did not. The change was repeatedly attributed to meetings "behind closed doors." Similarly, the Department of Education has threatened to close Kaʻaʻawa Elementary School despite community opposition.

- Residents are concerned about the effects of limited government budgets on local facilities and resources. Schools, parks, and civil defense budgets may all be affected.

- Disaster planning has emerged as a local initiative throughout the region, with an emphasis on stockpiling supplies needed in the event of emergencies.

- Tensions clearly exist among community leaders. These were evident when a petition to dissolve Neighborhood Board No. 28 in Koʻolau Loa was discussed, and in accounts of various parties involved in housing redevelopment in Kahuku who failed to meet to develop shared goals and proposals. However, Neighborhood Board meetings appear to

have proceeded without disruption, unlike more contentious boards elsewhere on O‘ahu. (The North Shore Board convened a meeting on the Hale‘iwa Hotel proposal that was rowdy and quickly adjourned. In this case, members of the audience were disruptive.)

In the course of interviews, respondents emphasized their deep commitment to “country” lifestyles. They list difficulties for local residents ranging from the inconvenient – Sears delivery service only on Sundays – to traffic congestion that can make the highway impassible during surf season. Still, no interviewee went on to suggest that they or their friends would leave the region because of such problems.

Interviewees mentioned the cost of housing and the limited availability of housing for residents as significant problems for the region. Illegal vacation rentals were sometimes mentioned as part of the problem, both as disruptive in residential neighborhoods and as affecting housing supply and prices.

The ideas of sustainability and food security, much discussed in Hawai‘i recently, have taken local form in the KNS region. First, much of the opposition to development has been expressed in terms of preserving the North Shore as a shared resource, a unique area enjoyed by the whole island and tourists from around the world. Next, many stakeholders are interested in maintaining the region’s agricultural resources. Third, major landowners – notably Kamehameha Schools and Hawaii Reserves Inc. – have identified the need for their regional resources to be increasingly self-sustaining.

Concerns with Regard to the Project

Redevelopment at Turtle Bay has been discussed in the KNS region for decades. The Proposed Action is seen by residents in relation to earlier proposals and discussions. The original master plan for the Kuilima EIS was welcomed by some as assuring economic stability, continuing jobs in the region, and opposed by others as bringing too much development, too many tourists, and too much traffic to the North Shore. Since the 1980s, public debates over development vs. open space have arisen again, notably with regard to plans for Lihi Lani, a recreational community, just north of Pupukea, for a proposed eco-camping resort at Pua‘ena, and, more recently, for a proposed Hale‘iwa hotel. Smaller residential subdivisions have been developed along the North Shore coastline. Along the Ko‘olau Loa side of the region, major new development has been proposed only by Hawai‘i Reserves, Inc., as part of the Envision Lā‘ie process, and little has been put in place.

At Turtle Bay, the 2005 announcement that the resort would carry out the development proposed in the Kuilima EIS revived old arguments, and several stakeholders developed the legal challenge that resulted in the Hawai‘i Supreme Court ruling that set the Kuilima EIS aside. The draft of the *Ko‘olau Loa Sustainable Communities Plan* spells out the concerns expressed in response to the proposal for expansion to the extent allowed in the late 1980s: [24]

> … many residents of Ko‘olau Loa do not support the resort expansion due to concerns about traffic impacts on the two-lanes of Kamehameha Highway, the capacities of existing infrastructure systems and public services to accommodate the future projected demand (e.g., water, wastewater, electrical systems, police and fire protection, and emergency services) and the potential impacts to archaeological, cultural and natural resources. Labor force issues related to population growth, housing demand and transportation, as well as a desire to preserve the undeveloped shoreline and scenic view planes and maintain the region's rural character are also concerns. Although there is general support for the existing hotel operations, community discussions about the future development of the resort continues [*sic*], pending completion of an updated EIS. Community concerns about the proposed resort expansion include:
>
> - Preserving the uninterrupted shoreline and scenic view plane, as well as the cultural and historic significance of the area for future generations;
> - Providing for appropriate recreational and other uses that are compatible with existing land uses;
> - Maintaining the viability of the existing Turtle Bay Resort, restaurants, condominiums and golf courses as an employment base for the region;
> - Minimizing the impacts of future development;
> - Developing design guidelines for any proposed additional structures to assure their compatibility with the rural character of the region;
> - Providing for appropriate agricultural and other compatible uses in the *mauka* area; and
> - Acknowledging existing land use designations and development approvals that have already been granted.

This entire discussion is included here both because it reflects input from local stakeholders on the Community Advisory Committee for the planning process and because it covers the range of concerns about the resort that arose in recent interviews. (We did not hear discussions of design

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[24] City and County of Honolulu, Department of Planning and Permitting, *Ko‘olauloa Sustainable Communities Plan Five-Year Review: Public Review Draft.* Honolulu, HI: 2010. The language quoted here was crafted largely in response to proposals by Oaktree, which sought development as permitted with the UA. Some of the concerns raised in the quotation have also been mentioned regarding the more limited Proposed Action. The Sustainable Communities Plan now in force and the draft update are more supportive of resort expansion than the stakeholders whose views are described in the above quotation.

guidelines, but did learn of people's concern that the resort be in keeping with the region's rural character.) Interviewees emphasized traffic congestion as the leading problem for the region. Some went on to discuss the resort expansion in relation to the need for jobs and housing in the region, and to inadequate infrastructure and public facilities. Others saw it as bringing too many tourists to the area, and as not needed.

The quotation above downplays differences in views of regional residents that could be heard in the course of interviews:

- The draft texts from the Department of Planning and Permitting emphasize opposition to the resort expansion; in interviews with BCH, both support and opposition were expressed. Many residents continue to see job creation as needed to support local communities, and welcome resort expansion for that reason.

- While view planes at Turtle Bay are important to some residents, others' attention focuses above all on their own home communities. Most interviewees said little about the appearance of the resort.

Comments on the SEISPN and at public events have covered the points raised above. Issues of concern to many include traffic congestion and protection of marine life (turtles and monk seals). Demands for careful archaeological studies and cultural sensitivity have been made forcefully; the archaeological inventory and cultural impact assessment conducted for TBR are part of the resort's response.

BCH staff asked interviewees to comment on the various alternatives and on components of the Proposed Action and alternatives that caught their eye. No consensus emerged. Some preferred the Kawela Conservation plan to the Proposed Alternative because it would limit development at Kawela Bay. A few preferred the Resort Residential Alternative because it involves no new hotels – while others saw a resort residential community as likely to be less responsive to the surrounding community than the operators of a mixed hotel and residential resort. A few said the Proposed Action seemed an appropriate and viable revision of earlier plans.

Some interviewees raised questions about the impact of resort development, especially resort residential development, on property values nearby.

Interviewees were also asked what steps they thought would be appropriate to mitigate effects of the Proposed Action. Some responses dealt with mitigation of specific anticipated impacts; others simply identified ways in which the resort could be of greater benefit to stakeholders:

- **Community housing**: KNS residents largely see "affordable housing" built to government pricing guidelines as unaffordable. Many do not trust the government or any developer to build homes that meet the needs of the regional community.

- **Unionization:** Several resort workers viewed the Proposed Action narrowly in relation to ongoing contract talks with the major union representing workers at the resort. They accused the hotel operators of increasing workloads in order to set a low baseline for

future expansion. They viewed expansion as likely to involve facilities that were not unionized, where wages, benefits and working conditions could be worse than at the current hotel.

- **Disaster planning:** Some residents suggested that the resort could help surrounding communities by providing an evacuation site upland or by supporting work to maintain resources that would help the community in case of disasters. A related concern was that additional visitors at the resort would make evacuation even more difficult for the region than it is already.

- **Control over parks**: Conversion of land at Kawela Bay and Kahuku Point to City and County parks would involve increased access for visitors as well as nearby residents. Some question whether the City and County would be able to maintain these parks well. One Kawela Bay resident has spoken publically of his desire for limited access to Kawela, and for policing of any park by the resort. Others may share his hope that new park areas would be kept clean and park usage would be monitored without aiming to limit local access.

- **Pedestrian and bicycle routes**: Some interviewees pointed to the Malaekahana bike path as a valuable addition to the community, and sought to see it extended from Kahuku past Turtle Bay toward Sunset Beach. They mentioned this as bringing together people from Kahuku and Lāʻie who enjoy it as a new pedestrian link between their communities.

These comments should be understood as pointing towards desired goals as much as an analysis of the merits of the Proposed Action or alternatives.

3.2.7 KNS Regional Economy

Local employers support at least some 6,200 jobs. (Many additional jobs exist in the region, but the employers – for example, the State Department of Education – are located elsewhere. In addition, agricultural jobs are not included in Table 3-10.) Figure 3-4 shows the Zip Code areas in the region.

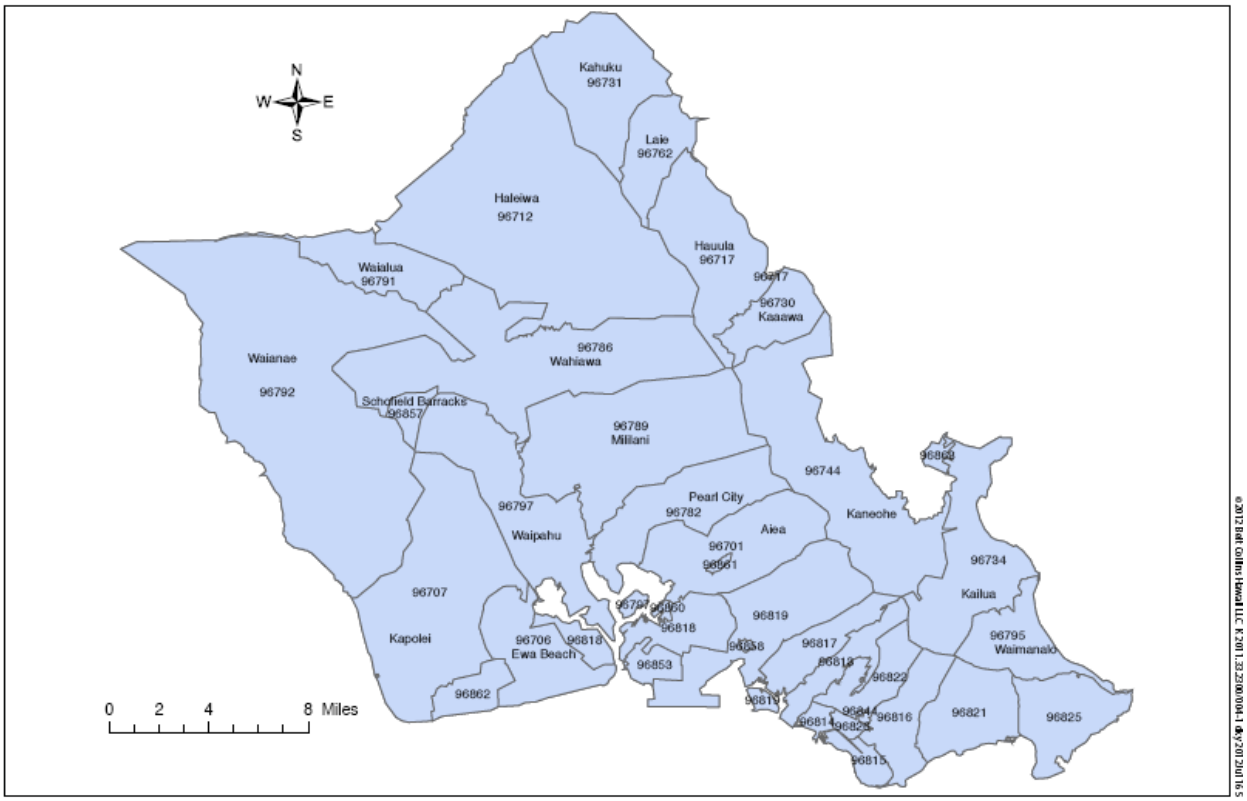
The largest employers are found in the Lāʻie and Kahuku ZipCode tabulation areas. These include the Polynesian Cultural Center, BYUH, Kahuku Medical Center and Turtle Bay Resort. Kahuku, with the Turtle Bay Resort and the Medical Center, has the highest average wage. Haleʻiwa is home to mid-sized retail and food service establishments. Alluvion, which grows and ships plants from Kawailoa, is also in the Haleʻiwa ZipCode area. On the other hand, few businesses are located along the coastline from Kaʻaʻawa through Hauʻula, and their workforce amounts only to 208 persons.

Table 3-10: Employment Patterns by Zip Code of Establishment, 2009

Area	ZipCode	2009 Business Patterns Data					
		Business Establishments	Workforce	Average No. Workers per Establishment	Average Annual Wage	Number of Establishments 50 to 99 Workers	Number of Establishments 100 or more Workers
Kaaawa	96730	10	60	6.0	$27,833	-	-
Hauula	96717	30	148	4.9	$25,601	-	-
Laie	96762	41	2,904	70.8	$18,826	4	2
Kahuku	96731	46	1,251	27.2	$33,160	1	3
Haleiwa	96712	202	1,491	7.4	$25,452	6	-
Waialua	96791	68	349	5.1	$31,350	-	-

SOURCE: ZipCode Business Patterns, 2009, downloads from http://censtats.census.gov/cgi-bin/zbpnaic/zbpsect.pl.

Figure 3-4: Zip Code Tabulation Areas, O‘ahu



Source: US Census

Figure 3-4
ZIP CODE TABULATION AREAS
Socio-Economic Impact Assessment, Turtle Bay Resort
July 2012

Table 3-11 provides more information on the work done by residents of the KNS region. The share of the workforce in the construction industry is high, especially in the North Shore CTs. On the Koʻolau Loa side of the region, workers in the accommodation/food service/arts and recreation sector are especially numerous. A large share of the jobs in Lāʻie, with a private university as well as public schools, is in education. Throughout the region, few workers are in the financial and real estate sector. Data on class of workers indicates that self-employment is high in the region, especially in CT 101 (Waimea-Kahuku).

Table 3-11: Industry and Class of Worker, 2006–2010

	City and County of Honolulu	KNS Region	Census Tract 102.01 Hauula-Kaaawa	Census Tract 102.02 Laie	Census Tract 101 Waimea-Kahuku	Census Tract 100 Kawailoa	Census Tract 99.02 Haleiwa	Census Tract 99.04 Kaena Point
Employed Civilian Workers	439,691	14,960	2,394	3,254	3,584	881	1,872	2,975
Industry								
Agriculture	0.8%	2.1%	1.5%	0.4%	1.2%	0.0%	6.0%	3.7%
Construction	7.2%	12.4%	13.7%	7.3%	15.3%	8.7%	9.1%	16.6%
Manufacturing	3.5%	2.3%	3.3%	1.0%	2.5%	3.4%	2.3%	2.6%
Wholesale trade	2.9%	1.7%	2.3%	0.7%	1.3%	0.2%	1.8%	3.4%
Retail trade	11.1%	10.0%	7.8%	7.9%	12.6%	6.0%	14.2%	9.7%
Transportation, Warehousing, Utilities	6.0%	3.3%	2.9%	3.3%	2.2%	3.7%	4.3%	4.3%
Information	2.1%	1.7%	1.6%	1.2%	2.0%	0.9%	0.5%	3.1%
Finance, Insurance, Real estate	7.2%	4.0%	4.8%	3.7%	3.8%	0.0%	4.4%	4.7%
Professional, administrative services	10.2%	7.3%	7.4%	6.3%	2.8%	18.8%	10.6%	8.2%
Education and Health	21.7%	25.5%	28.8%	39.0%	23.2%	19.4%	17.6%	17.7%
Accommodation, Food Service, Arts, Recreation	13.6%	19.8%	14.5%	26.1%	23.3%	21.3%	17.3%	14.1%
Public Administration	9.5%	5.7%	8.8%	1.7%	4.5%	12.6%	8.6%	5.3%
Other services	4.3%	4.0%	2.7%	1.5%	5.3%	4.8%	3.2%	6.6%
Class of worler								
Private wage & salary	71.5%	70.9%	67.1%	80.7%	64.9%	67.1%	72.8%	70.3%
Government	21.9%	18.6%	23.1%	13.6%	18.1%	25.3%	17.7%	19.5%
Self-Employed	6.4%	10.5%	9.9%	5.5%	17.0%	7.6%	9.5%	9.9%
Unpaid family workers	0.2%	0.1%	0.0%	0.2%	0.1%	0.0%	0.0%	0.2%

NOTE: The ACS is based on a series of samples, not an enumeration of the whole population, and is less reliable for cells with small counts. The table refers to residents of the region, who may work in the region or elsewhere.
SOURCE: American Community Survey data, 2006-2010, downloaded from www.census.gov.

Some 80% of the employees of the Turtle Bay Resort live in the KNS region. A recent count of 500 employees' home ZipCodes (provided by TBR) shows 213 (43%) as living in Koʻolau Loa and 189 (38%) in North Shore ZipCodes. The only other region with more than a few employees was Central Oʻahu, with 76 (15%). In sum, about 40% of employees travel to and from the resort from the Koʻolau Loa side, and about 60% travel along the highway on the North Shore.

Major Industries

While agriculture was once the local mainstay, its role is smaller nowadays. In Waialua District, much of the land that once was used by Waialua Sugar is now planted in seed corn. Coffee

production, floriculture and vegetable farming have also developed. Cows and horses are still raised in the region, although the local dairy closed in the 1990s. On the Koʻolau Loa side of the region, the remaining farms are mostly small-scale operations. Aquaculture has been developed in the Kahuku region, focusing on shrimp, with mixed success. Lunch trucks offering shrimp plates have done well, and now are a common stop on circle-island tours.

The major industry in the local economy is tourism. The North Shore is renowned as the home of big-wave surfing, and is a destination for visitors' day trips. The PCC in Lāʻie and Waimea Falls Park also attract visitors on circle-island trips. The Turtle Bay Resort not only serves its overnight guests but attracts tourists staying elsewhere and local residents to its beaches, golf courses, and restaurants.

Retail and other commercial establishments are concentrated in Haleʻiwa. In Koʻolau Loa, only Lāʻie supports a retail center larger than a strip mall. The region had industrial centers at the sugar mills in Waialua and Kahuku. Nowadays, the Kahuku Sugar Mill houses a mix of commercial establishments and civic offices, while the Waialua Mill site is home to a mix of small businesses, including surfboard makers, a soap factory, and food vendors. Coffee, chocolate and soda are manufactured in Waialua.

In the KNS region, much of the upland area is used by the U.S. Army and the Marines for training. The training areas may be reached through roads from Central O`ahu not used by the general public, or by convoys on public highways, or by air, with helicopters traveling over the water most of the way from Marine Corps Base Hawaii Kaneohe Bay, then crossing the shoreline area near Kahuku Point or Kawailoa to reach training areas. Also, a military housing area is located at Helemano, just within the North Shore SCP area.

3.2.8 Economic Trends and Proposed Development

For the region's establishments, the average reported wage in 2009 was $24,263. The ACS employed civilian labor force of about 14,960 is more than twice as large as the job count in Table 3-10: most regional workers must travel outside the KNS region to find work. Reported commute times are longer than the island average (except in the Lāʻie and the Kawailoa CTs).

The two major developments that could affect the local economy and employment are the expansion of Turtle Bay Resort and Envision Lāʻie, a planning process sponsored by Hawaii Reserves, Inc., the landowner. Both would support job growth and provide housing. The Turtle Bay Resort expansion would provide new jobs for residents throughout the KNS region.

Job growth through Envision Lāʻie would be more narrowly targeted, since Lāʻie's job centers are closely tied to Mormon church and educational activities. If new housing is for workers in the Lāʻie job centers, it could address crowding in that community with only limited impact on problems of cost and crowding elsewhere in the region. Some 1,260 units have been proposed to

be built out over 25 years.[25] The proposal nearly doubles the Lāʻie housing stock. It could add far more housing to the regional stock than the Proposed Action.

The new inn at Lāʻie would have up to 224 rooms and limited amenities (e.g., a coffee shop rather than a full restaurant). It would not be a resort comparable to Turtle Bay. It would primarily serve PCC and BYUH visitors and visitors to Koʻolau Loa families.

Work has already been completed on projects within the existing footprints of BYUH and the PCC. The Honolulu City Council approved the Special Management Area permit for the new hotel in 2011. New land use approvals would be needed for the university expansion and for a new residential area towards Malaekahana, so the scope and timing of these is currently unknown.

The leading Haleʻiwa landowner, Kamehameha Schools, completed a Master Plan for its North Shore lands in 2008. It includes renovation and expansion of commercial areas in Haleʻiwa, along with limited new residential development. On Kamehameha Schools land, the Kawailoa Wind project is now beginning construction. It would generate approximately 70 MW of power, and be Hawaiʻi's largest wind power facility. The towers are to be located well inland, and would be far less visible than the facility now operating at Kahuku, which was also built by First Wind.

Other new major projects that have been proposed (and opposed) include:

- Relocation of the Hauʻula fire station to commercial land acquired from local owners;
- A second wind farm project in Kahuku, which has been opposed by local stakeholders because its proponents failed to consult the community but claimed to have done so;
- A 75,000-square foot commercial development near the Sunset Beach supermarket was proposed, but plans are on hold, and the developer, Honu Group Inc., does not mention this project on its website; and
- A small hotel to be located near the shore at Haleʻiwa: This would occupy part of the land that the City and County had bought for park expansion; the proposal has inspired intense discussion in the community.

The North Shore Sustainable Communities Plan, passed by the Honolulu City Council in 2011, incorporates plans for revitalization of Haleʻiwa and Waialua as country towns, with new housing allowed nearby. In Haleʻiwa, the landowner and stakeholders support continuing retail development and creation of a community gathering place. For Waialua, industrial redevelopment at the mill site is supported.

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[25] This figure was included in revisions to the Draft Koʻolau Loa SCP supported by several Lāʻie and Kahuku members of the SCP advisory group in 2009 (posted at http://envisionlaie.com/wp-content/downloads/kscp_proposed_amendment.pdf). The developer has not recently provided a revised total for housing to be built at Malaekahana.

3.2.9 Infrastructure

As a two-lane roadway, Kamehameha Highway's size limits traffic flow throughout the KNS region. The Haleʻiwa Bypass (Joseph P. Leong Highway) provided a local response to congestion. At Waimea Bay, road improvements and cliff stabilization were needed after a major rock fall in 2000, but another fall in 2007 resulted in a brief closure.[26] The City and County's Parks and Recreation Department has plans for support parks, notably at Laniakea, which could reduce roadside parking and unmanaged pedestrian crossings.

A new pedestrian and bike path opened in 2011 in Malaekahana, linking Lāʻie and Kahuku, as part of the Envision Lāʻie initiative.

The City and County of Honolulu has been seeking a new municipal sanitary landfill site to replace Waimanalo Gulch. A citizen committee has recently identified criteria for preliminary ranking of potential sites before land owner, city, state and federal guidelines are evaluated. Based on their input, a site immediately upland from the Turtle Bay Resort has emerged as the preferred location for a new landfill.[27] The site is under the control of the federal government, and is part of the Army's Kahuku Training Area. The City and County of Honolulu does not have the authority to take Army land without federal consent. Apparently, no consultation with federal authorities had occurred at the time of the study because the analysis was limited to an evaluation of physical land characteristics and did not take into account land ownership.

3.2.10 Similarities and Differences of the Two SCP Areas

The two SCP areas share "country" lifestyles, but these are realized in different ways in different communities.

The racial data in Table 3-2 show the KNS region, as a whole, being distinctive on the island of Oʻahu for its lower share of Asian residents and its large proportion of White residents. Koʻolau Loa has a higher proportion of Native Hawaiʻian and Pacific Island residents than the island as a whole.

Koʻolau Loa and North Shore stakeholders, working with the City and County's planners, have developed similar long-term visions for their areas:

> … Koʻolau Loa seeks to preserve the region's rural character and its natural, cultural and scenic resources. The community envisions a safe and healthy environment based on strong family values, where residents have access to quality jobs, affordable housing, and ample recreational opportunities within the region. Koʻolau Loa will remain country, characterized by small towns and villages with distinctive identities that exist in harmony with the natural settings, defined by

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[26] Park, G. "Waimea Bay Rocked Again." *Honolulu Star-Bulletin.* April 8, 2007. Posted at http://archives.starbulletin.com/2007/04/08/news/story01.html.

[27] *Pacific Business News*, April 25, 2012. http://www.bizjournals.com/pacific/news/2012/04/25/kahuku-sites-now-top-oahu-landfill.html.

> the mountain ridges and scenic open spaces which help to give the region its unique form of organization.[28]
>
> The North Shore in the year 2035 retains the unique qualities that have long defined its attractiveness to residents and visitors alike. Scenic open spaces are protected and maintained, coastal resources are enhanced, and the region's Native Hawaiian heritage, cultural diversity, and plantation past have been carried forward in the revitalization of its communities.[29]

The former vision emphasizes the continuing wellbeing of local communities rooted in existing towns; the latter emphasizes open space, and treats towns as sites to be "revitalized." This difference is not new, and it is not simply a difference between the two SCP Areas within the region. [30] Areas where many residents value their coastal strip and ocean as "country" include Kaʻaʻawa and Punaluʻu in Koʻolau Loa as well as most of the North Shore. Similarly, "community" orientation and the hope of continuity for families and neighborhoods, from the plantation past to an uncertain present and future, is found as much in Waialua as in Kahuku or Lāʻie.

Local stakeholders in Haleʻiwa and Waialua see their communities as distinct towns with economic hubs to be supported, i.e., Haleʻiwa's mix of tourist retail and other businesses, and Waialua's Sugar Mill redevelopment area. Much the same could be said of Kahuku and Hauʻula in Koʻolau Loa, but their commercial areas appear less successful. Lāʻie stands out because its major employers are closely interrelated. The PCC depends on BYUH for much of its workforce, while it provides financial support to the university. Its economic organization follows from its role as a church center.

The growth of surfing and the surf industry has brought a younger population and an orientation to the ocean, more than to land resources, to the North Shore. The high levels of unemployment in the Haleʻiwa and Kawailoa Census Tracts is understandable if many residents live on the North Shore to enjoy the ocean, and do not need to support families or are willing to accept marginal economic conditions so long as they can live there. Many on the North Shore see their environment as a resource for the island and the entire world, not just for their own community. Accordingly, they may be more concerned with environmental protection than with economic sustainability. However, residents of communities throughout the region support both of these values and assess new initiatives in light of them both.

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[28] City and County of Honolulu, Department of Planning and Permitting, *Koʻolau Loa Sustainable Communities Plan Five-Year Review: Public Review Draft.* Honolulu, HI: 2010, p. 2-1.

[29] City and County of Honolulu, Department of Planning and Permitting, *North Shore Sustainable Communities Plan: Public Review Draft.* Honolulu, HI: 2010, p.2-2

[30] The Socio-Economic Impact Assessment for the Kuilima EIS made much the same point in 1984:

> "At a very general level, there is an apparent value difference between residents who are primarily concerned with preserving a 'country' feeling and those who are more concerned with preserving a current 'community' for existing family and friends. While most people would like both, they tend to lean to one or the other if forced to choose." (Community Resources, Inc. and A. Lono Lyman, Inc., Appendix J to the Kuilima EIS, page 4).

3.2.11 Comparison of Current Socio-Economic Trends with Trends Discussed in the 1985 Kuilima EIS

The SEIS Lands and the Resort

Before the Kuilima EIS was processed, parts of the site were under short-term agricultural or residential leases. The leases were not renewed, and beach cottages along the eastern half of Kawela Bay on the SEIS lands were demolished. A major difference between the current situation and that of the Kuilima EIS is that the Proposed Action does not involve displacement of private homes or activities.

In the early 1980s, the hotel had low occupancy levels, and development permits did not, in the view of the owners, allow for adequate growth to achieve a prosperous level of operations. After the 1985 EIS was accepted, the owners took steps towards expansion but soon found they could not implement their plans for macro-economic reasons. In the intervening years, the hotel has been refurbished, and has come to have higher occupancy levels. The Ocean Villas have expanded the resort's offerings. Turtle Bay is now a viable resort operation. It has development permits for expansion and the owners plan to implement a phased development plan.

Regional Economy

In the 1980s, the KNS region was characterized by lower incomes and employment than the rest of the City and County of Honolulu, and by a narrow economic base. The region stood out as the center for aquaculture in Hawai‘i. Tourism was recognized as offering "the greatest promise for providing new employment and business opportunities" on O‘ahu.[31] While the region included major visitor attractions (at PCC and Waimea Valley), the EIS treated residents as more dependent on agriculture and fishing than tourism. Since then, the surf and visitor industries of the region have expanded, and the North Shore's reputation has grown. Only 2.1% of the civilian workforce is in agriculture (as shown in Table 3-11).

Tourism is now the region's leading industry. Household incomes for most of the region approach or exceed the island median. However, regional unemployment remains above the island average. Commute times for most of the region are still longer than for other parts of O‘ahu and are longer than reported in 1980.

Populations and Communities in the Region

Demographic changes include population growth and aging of the overall population (from medians in the region of about 25 years in 1980 to about 32 years of age in 2010). Changes in ethnic composition are not easily specified, since classification schemes for race and ethnicity have changed, but a marked increase in the share of the population identified as (at least in part) White has occurred. However, occupancy rates have changed little.

Housing Market

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[31] Community Resources, Inc. and A. Lono Lyman, Inc. *op. cit.*, page 6.

Housing costs on O‘ahu have increased greatly over the last thirty years, and the ratio of housing costs to incomes has increased as well. In parts of the KNS region, rentals to vacationers or surfers have tended to increase rents and limit the inventory available to residents. Elsewhere on O‘ahu, single-family housing and condominiums have been built in large new subdivisions, but housing development in the KNS region has been far slower than in Central O‘ahu and ‘Ewa. Available housing within the KNS region is even more limited and costly than before.

Emerging Trends

The 1985 Kuilima EIS dealt at length with the demographics, economy and aspirations of the region. By that time, the closing of Kahuku Sugar had transformed the economy of Ko‘olau Loa, and it was clear that Waialua Sugar would close in the near future. Tourism was recognized then as a critical source of new jobs for the region.

The SIA emphasized that the City and County *General Plan* guidelines called for slow population and housing growth – but that existing approvals already provided capacity for a population of approximately 30,400 by 2000. (The actual 2000 population, as shown in Table 3-1, was 108% of the estimated capacity.)

The traffic analysis conducted for the 1985 EIS incorporated assumptions of continuing growth of traffic in the region: traffic was seen as increasing faster than population or housing.

These facts can be read in two ways in relation to the current situation in the region. On the one hand, the problems of a limited economic base, inadequate housing supply, and traffic congestion remain. Expansion of the resort is a source of jobs for many and some homes affordable for KNS families. To the extent that the expanded resort will provide recreation and other activities for its visitors, it might not add much to, and might even reduce, the circle-island visitor traffic in the region. However, some observers emphasize traffic congestion and housing demand, and claim that the need for an alternative job base is no longer pressing. They value the existing resort as a regional amenity but question the need for expansion.

The data reviewed above indicate that local job sources fail to meet the employment needs of many KNS residents, limiting employment for some and forcing others to commute long distances or to leave the region to find work. Both local employment demand and traffic congestion indicate that the main themes of the regional socio-economic analysis provided in the Kuilima EIS are still valid.

4 Socio-Economic Effects of the Proposed Action

Major socio-economic effects of resort expansion can be discussed as emerging from economic changes (capital coming to Hawai‘i for resort construction and, later, as visitor spending) that propel population changes (increased numbers of visitors and resort residents, new housing for local workforce families, incomes that support local families and allow successive generations to stay in the region, rather than move to other areas), and fiscal impacts (new government revenues and the cost of meeting increased demand for public services). These effects may then lead to ones that involve interactions between visitors and residents.

As discussed in Section 1.2, the effects of new development can be counted as “impacts” only in relation to an allowed action future baseline. If the baseline – the existing situation and potential development permitted under current laws – involves development, then the “impact” is the difference between permitted and proposed development. At Turtle Bay, the permits now in force allow for development of the Full Build-Out Alternative. The Proposed Action scales down new development, and limits its footprint.

In this chapter, the effects of the Proposed Action are contrasted with those of the No Action Alternative. Effects of the Full Build-Out Alternative and other development alternatives are assessed later.

It is useful to deal first with quantifiable effects. Once these have been discussed, readers are better able to assess whether significant qualitative effects occur. For quantitative and qualitative effects alike, both the development of effects over time and the cumulative effects deserve study. This chapter deals with effects of the Proposed Action; effects of the alternatives are discussed in the next chapter.

The Proposed Action will bring more visitors and workers to the resort. Wages from resort and resort-related jobs will in turn support resident households in the region. For this reason, population and housing effects are discussed below after estimating the number of operations jobs created by visitor spending, both at the resort and elsewhere in the region.

This chapter provides a step-by-step account of the estimation of demographic, economic and fiscal impacts of the Proposed Action. Sources for the analyses are shown as notes to tables. Some are discussed in more detail in Appendix B. The costs and benefits of the Proposed Action are summarized in Chapter 7.

4.1 Employment and Wages

The Proposed Action will bring both short-term jobs during the construction period and continuing operations jobs. Construction will involve an estimated 3,263 direct jobs over 11 years. Construction workers on-site at the resort during that period will number about 237 on average. The number of new continuing operations positions at the resort will climb to about

753. Next, visitor spending will not be confined to the resort, so the attraction of additional visitors to Turtle Bay will support an estimated 443 additional jobs in Hawai‘i by 2025.

Wages from both construction and continuing jobs will support island households. By 2025, the regional increase in wages is expected to be more than $30 million annually (2011 dollars, based on $23.8 million in resort operations wages and $7.4 million in the KNS region for off-site tourism-related work).

Investment in new facilities creates short-term jobs during the construction period and continuing jobs in building and landscape maintenance, security and administration. Visitor spending supports operations jobs on a continuing basis. While both have effects throughout the island economy, construction and construction-related jobs do not have much effect on the regional population size, except by providing nearby, relatively reliable jobs for residents of the region who are already construction workers.

4.1.1 Construction Employment and Wages

Project construction would begin as soon as building permits are granted. Assuming that construction begins in 2014, the completion schedule in Table 4-1 is expected:[32] Construction-related jobs would last until build-out.[33] All construction jobs are estimated as full-time jobs for a given year. These fall into the following categories:

1. On-site construction jobs: workers at the resort. Their number is estimated on the basis of annual construction spending. The actual number of workers on a given day would vary according to the jobs to be done.

2. Other direct construction jobs: Firms responsible for construction have workers at their offices and base yards as well as on-site. As a rule of thumb, on-site workers account for 80% and off-site workers account for 20% of direct construction jobs.

3. Indirect jobs: These are jobs supported when construction firms buy materials and services locally.

4. Induced jobs: These jobs are supported by expenditure of wages of direct and indirect workers. These include, jobs in retail trade, or educational and health services.

The distinction among direct, indirect and induced employment comes from Input-Output analysis. The models developed and maintained by the State Department of Business, Economic Development and Tourism (DBEDT) provide multipliers for indirect and induced jobs by

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[32] The construction timetables in this report follows from an analysis provided by TBR. It depicts a process of market absorption. It should be viewed as a best estimate of likely demand over several years, rather than a strict, year-by-year, prediction of what will be built and sold at the resort.

[33] This account does not include design and engineering jobs which are not closely tied to the schedule.

industry. The specific multipliers used are identified in Appendix B. Table 4-2 shows construction spending and the associated workforce for the Proposed Action.

Construction work ends when a structure is built. The job counts for the entire period are person-years of employment, over the 11 years of construction. As shown in Table 4-2, the average on-site construction workforce would number approximately 237 over 11 years.

Table 4-1: Construction Timetable, Proposed Action

	Cumulative, through 2025	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
New hotel units, for occupancy in year		30	30	30	64	65	60	70	70	70	71	65
New residential units, for occupancy in year												
Resort Residential		131	74	75	47	48	49	49	38	37	27	15
Community Residential		44	25	19	19	19	13	13	8			
Hotel units built by end of year	625	30	60	90	154	219	279	349	419	489	560	625
Residential Units built by end of year												
Resort Residential	590	131	205	280	327	375	424	473	511	548	575	590
Community Residential	160	44	69	88	107	126	139	152	160	160	160	160
Share of infrastructure $$ spent by end of year	100%	35%	45%	46%	52%	59%	65%	94%	96%	97%	99%	100%

SOURCE: TBR.

Table 4-2: Construction-Related Jobs and Wages

	TOTAL	Annual Data 2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Construction Spending (million, 2011 $s)												
Infrastructure	$148.5	$48.0	$14.4	$3.5	$8.9	$10.4	$9.2	$40.2	$4.3	$3.3	$3.4	$2.9
Buildings	$324.4	$46.5	$31.8	$30.4	$32.6	$26.4	$23.1	$29.7	$25.7	$26.0	$27.4	$24.9
Single Family	$297.0	$49.8	$26.4	$26.7	$26.4	$31.0	$32.0	$32.8	$25.3	$22.5	$18.3	$5.9
	$769.9	$144.3	$72.5	$60.6	$67.9	$67.8	$64.3	$102.7	$55.3	$51.9	$49.1	$33.6
Direct Construction Workforce												
Infrastructure	564	183	55	13	34	39	35	153	17	12	13	11
Buildings	1,363	195	133	128	137	111	97	125	108	109	115	104
Single Family	1,336	224	119	120	119	140	144	147	114	101	82	26
	3,263	602	307	261	290	290	276	425	238	223	210	142
On-site Const. workers	2,611	482	245	209	232	232	221	340	191	179	168	113
Construction period (yrs.)	11											
Average annual on-site FTE	237											
Indirect and Induced Jobs	5,482	1,011	515	439	486	487	463	714	400	375	353	238
Wages (million, 2011 $s)												
Direct	$225.3	$41.6	$21.2	$18.0	$20.0	$20.0	$19.0	$29.4	$16.4	$15.4	$14.5	$9.8
Indirect and Induced	$247.7	$45.7	$23.3	$19.8	$22.0	$22.0	$20.9	$32.3	$18.1	$16.9	$16.0	$10.7
Total Wage Impact	$473.0	$87.2	$44.4	$37.9	$42.0	$42.0	$40.0	$61.6	$34.5	$32.4	$30.5	$20.5

NOTES: Construction spending estimated by Belt Collins Hawaii, based on input from TBR. Workforce counts based on recent job counts per construction spending. On-site workforce estimated on assumption that 20% of direct workforce is at baseyards, offices or otherwise off-site. Indirect and induced jobs estimated from Hawaii State Input-Output Model. Wages estimated from data for the construction industry and for all covered employment, for City and County of Honolulu, in 2009, adjusted to 2011 wages in proportion to changes in the Consumer Price Index. The numbers shown are rounded, so totals may differ slightly from the sum of the individual numbers in the table.

SOURCES: DBEDT, 2012, 2011, 2009; DLIR, 2011.

4.1.2 Operations Employment and Wages

A resort development demands staffing not just for accommodations, but also in food services, landscaping, building services, security and real estate. With an increased visitor population, demand for recreation would create additional jobs as well. Some retail jobs would be on-site at the resort, in hotels, in the new Gathering Place or at the farmer's market.

Operations jobs are expected to continue so long as a resort attracts visitors and residents. Spending at the resort would generate indirect and induced jobs in turn. Table 4-3 shows both direct jobs and indirect and induced ones.

Resort visitors also spend money off-site, for transportation, services, food and goods. The number of jobs involved can be estimated on the basis of statewide data on the jobs supported in the state economy by visitor spending. These jobs are calculated by DBEDT as direct and indirect jobs. For the present analysis, total spending by resort visitors for items other than lodging is estimated, and the associated jobs are counted. Off-site jobs can be estimated by subtracting out the on-site jobs from the total jobs supported by visitor spending, as shown in Table 4-4:

Table 4-3: On-Site Operations Jobs and Related Jobs, Proposed Action

	2025 -- Full Absorption	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Operations Jobs												
Direct Workers												
Hotel	511	25	49	74	126	179	228	285	342	400	458	511
Food and Beverage	140	8	15	22	36	51	64	80	95	110	126	140
Retail	51	3	6	9	14	20	24	30	35	41	46	51
Recreation Services	7	0	1	1	2	2	3	4	4	5	6	7
Landscaping	13	2	3	4	5	6	7	9	10	11	12	13
Security	13	2	3	4	5	6	7	9	10	11	12	13
Realty/Management	19	2	3	5	6	8	10	12	14	16	18	19
Direct Total	753	41	79	117	194	272	344	428	511	593	677	753
Indirect + Induced Workers	785	42	81	120	201	282	357	444	531	618	706	785
Total	1,539	83	160	237	395	554	701	872	1,042	1,211	1,383	1,539
Annual Wages (Million 2011 $s)												
Direct Workers	$23.8	$1.3	$2.5	$3.7	$6.1	$8.6	$10.9	$13.5	$16.1	$18.7	$21.4	$23.8
Indirect and Induced Workers	$35.5	$1.9	$3.7	$5.4	$9.1	$12.7	$16.1	$20.1	$24.0	$27.9	$31.9	$35.5
Total	$59.2	$3.2	$6.1	$9.1	$15.2	$21.3	$27.0	$33.6	$40.1	$46.6	$53.2	$59.2

NOTES: Employment estimated by Belt Collins Hawaii, based on development timetable and employment at Turtle Bay and comparable resorts. Job counts are based on the number of units built or occupied, as described in Appendix B. Sources for indirect and induced jobs and for wage estimates by industry are the same as in the preceding table, using the multipliers for the industries shows in the table. (See Appendix B for multipliers.) The numbers shown are rounded, so totals may differ slightly from the sum of the individual numbers in the table.

SOURCES: DBEDT, 2012, 2011, 2009; DLIR, 2011.

Table 4-4: Off-Site Employment Supported by Visitor Spending

	2025 -- Full Absorption	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Visitors Staying Overnight in New Units												
Total	2,206	221	386	553	729	921	1,102	1,326	1,534	1,753	1,997	2,206
Adjusted total, spending	1,862	154	280	406	562	727	880	1,068	1,248	1,440	1,664	1,862
Spending, Non-lodging												
Per person per day	$104.73	$104.73	$104.73	$104.73	$104.73	$104.73	$104.73	$104.73	$104.73	$104.73	$104.73	$104.73
Annual (Million $s)	$71.2	$5.9	$10.7	$15.5	$21.5	$27.8	$33.7	$40.8	$47.7	$55.0	$63.8	$71.2
Jobs from Visitor Spending												
Total (Direct and Indirect)	765	63	115	167	231	299	362	439	513	592	686	765
minus On-site (DII)	322	24	42	61	95	127	158	192	226	259	293	322
Off-site (DI)	443	39	73	106	137	172	205	246	287	333	393	443
Regional Share	177	16	29	42	55	69	82	99	115	133	157	177
Wages, Off-site (Million $s)	$18.4	$1.6	$3.0	$4.4	$5.7	$7.1	$8.5	$10.2	$11.9	$13.8	$16.3	$18.4
Regional Share	$7.4	$0.7	$1.2	$1.8	$2.3	$2.9	$3.4	$4.1	$4.8	$5.5	$6.5	$7.4

NOTES: Visitor total is all visitors in new hotel and resort residential units. "Adjusted total, spending" counts only half of the visitors in residential units, since (a) some of these may stay for longer periods, and spend less per day, and (b) these seem more likely to patronize big box stores outside the KNS area. Off-site jobs estimated from average non-lodging visitor spending per-person per day in Hawai'i, 2010, and statewide ratio of jobs generated by visitor spending (including direct and indirect jobs) as modeled by DBEDT for 2010. Visitors in the Proposed Action are assumed to spend 110% of average visitors to Hawai'i. Direct jobs generated on-site (excluding accommodations jobs) plus associated indirect and induced jobs are subtracted from the total. For consistency, average wage for visitor spending direct and indirect jobs is also taken from the State model (Data Book Table 7.32) which shows $41.505.50 in household income associated with each visitor-related job (including indirect jobs) as of 2010. Regional share of off-site jobs estimated by Belt Collins Hawaii LLC as 40%, based on visitor spending patterns (by industry) analyzed by DBEDT. The numbers shown are rounded, so totals may differ slightly from the sum of the individual numbers in the table, and shares of totals may reflect unrounded numbers.

SOURCES: DBEDT, 2011a, 2011b.

4.2 Population Growth and Distribution

As of 2025, the Proposed Action is expected to increase the number of people staying overnight at the Turtle Bay Resort (including the hotel and Kuilima Estates) from about 1,267 visitors and residents to approximately 4,167 persons on average (an increase of 2,900). During the daytime, many of these people would go outside the resort, but employees and day visitors would come to the resort. The daytime population growth with the Proposed Action is estimated as from about 1,485 to about 4,401 (an increase of 2,916).

Population growth at Turtle Bay Resort has already been anticipated in government projections for slow increases in the region's resident population.

4.2.1 Population at the Resort

Three different sorts of population effects are discussed in this report. With new hotel units and housing, the number of persons staying overnight on-site increases. During the daytime, many residents and some of the visitors staying on-site will be elsewhere, but the on-site population includes operations workers, construction workers, and day visitors to the resort. Regional population effects are estimated as including (a) new visitors to the resort and resort residents, (b) residents of community housing who come from outside the region, (c) persons who come to the region to take jobs supported by visitor spending, whether jobs at the resort or elsewhere in the region. On-site totals are typically larger than regional totals because many residents living at the resort or, supported by resort-related jobs and living elsewhere in the region, are not new to the region.

Currently, approximately 1,485 persons are at the Turtle Bay Resort at any given time, not counting construction workers. The number of persons present may be greater, when major events such as concerts or the Fourth of July celebrations attract people from outside the resort. Table 4-5 shows the breakout of persons estimated as on-site on, say, a weekday that is also a state holiday, when many residents might remain on-site. Table 4-6 provides a similar account of population with the Proposed Action.

4.2.2 Population Effects throughout the KNS Region

Table 4-7 estimates the new regional resident population anticipated with the Proposed Action, taking into account both new on-site population at the resort and population supported by new jobs throughout the region. The Proposed Action would contribute about a third of resident population growth for the 2025 KNS region, as shown in Table 4-7. (This calculation involves allocating to the region a share of island-wide effects. The shares shown are selected to provide a high but realistic estimate of regional effects.)

Table 4-7 combines counts of resort visitors and new regional residents to estimate the regional de facto population increase associated with the Proposed Action. However, no regional de facto

count of residents and visitors either passing through or staying in the region has been published, so this population cannot be compared either to a current total or projected growth.

Table 4-5: Estimated On-Site Daytime Population, Existing Turtle Bay Resort

	Daily (1)	Around noon (2)
Hotel and Ocean Villas guests	850	638
Kuilima Estates		
FT Residents	223	167
PT residents, visitors	194	146
Day visitors	Varies	96
Operations workforce, by industry		
Accommodations	350	280
Food and Beverage	115	69
Retail	25	13
Recreation Services	25	23
Landscaping	28	25
Security	35	18
Realty/Management	12	12
Subtotal	590	439
Construction workers (3)	14	12
Total		1,497

NOTES: Estimated from data provided by TBR, other operators, traffic study survey, and 2010 U.S. Census data. Day visitors include a few golfers, riders, surfers, and visitors to restaurants, but their numbers can be much larger during conferences, contests or concerts. The numbers shown are rounded, so totals may differ slightly from the sum of the individual numbers in the table.
FT = full-time; PT = part-time.

(1) Present at some time for an average day. Not all employees are likely present at the same time.

(2) On-site at the same time, during a typical day, e.g., at noon. Some 75% of guests and residents expected to be present.

(3) Some renovations may be ongoing at any time. The figure used here is a rough estimate of the possible average over time, based on recent traffic counts.

The new on-site population at the resort (in Table 4-6) is larger than the new regional population (in Table 4-7). That is because much of the population new to the resort would come from the region: the community housing would largely serve families from the region.

Table 4-6: Estimated Turtle Bay Resort On-Site Daytime Population, based on Proposed Action

	Existing Resort	2025 -- Full Absorption	New Daytime Population with Proposed Action										
			2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Hotel , Ocean Villa guests	638	1,139	65	130	194	297	400	493	607	721	845	998	1,139
Resort Residential (including Kuilima Estates)													
FT Residents	167	41	9	14	20	23	26	30	33	36	39	40	41
PT residents, visitors	146	516	101	160	221	250	291	334	387	429	470	499	516
Community Residential		479	132	206	263	320	377	416	455	479	479	479	479
Day Visitors	96	180	62	84	86	108	130	151	165	169	172	176	180
Operations workers	439	561	30	59	87	145	202	256	319	380	442	504	561
Construction workers	-	-	245	209	232	232	221	340	191	179	168	113	-
Total	1,485	2,916	645	862	1,102	1,374	1,647	2,020	2,157	2,393	2,614	2,811	2,916

NOTE: Only construction workers involved in new construction (rather than renovation) are included. Day visitors are expected to increase as Kawela Bay and other areas open to the public and as resort amenities become available. Golfers from outside the resort would decrease with fewer holes available on the Fazio Course. The Proposed Action would increase the number of persons on-site to a total of 4,358 after build-out. The population associated with the existing resort accounts for 34% of that total. The numbers shown are rounded, so totals may differ slightly from the sum of the individual numbers in the table.

Table 4-7: Estimated Contribution of Proposed Action to Regional Population Increase

	2010	2025
Regional Population Estimates		
DPP Forecast (2009)	31,880	34,276
2010 Census + Adjusted Forecast (1)	34,452	37,041
Resident Population Groups Associated with Proposed Action		*Islandwide*
A. TBR Resort Recreation Residents		55
B. TBR Community Housing Residents		638
C. Direct Operations Workforce Households (2)		1,613
D. Indirect and Induced Operations Workforce Households (2)		896
E. Off-Site Workforce Households (2)		505
Total (assuming unduplicated counts)		3,707
Potential New Regional Resident Population (3)		*KNS Region*
A. 100% of group		55
B. 30% of group		192
C. 20% of group		323
D. 20% of group		179
E. 40% of group		202
Total		**951**
Share of Projected Regional Population Increase		36.7%
Regional New De Facto Population Change		
New Regional Resident Population with Proposed Action		951
New TBR Visitor and Part-time Population		2,206
Total		3,157

NOTES: See Tables 3-8, 4-3, 4-4, 4-6.

(1) Adjusted estimate applies DPP projected growth rates, but starts from the actual 2010 Census population.

(2) For this calculation, the ratio of workers to residents in KNS households in 2010 was used to estimate workforce household populations.

(3) Regional population growth can occur either when housing opens up for people to move into the region or when jobs open up, making it possible and attractive for workers to move (or move back) to the region. In the case of Community Housing, the estimate is of households whose place in existing housing units will be taken by in-migrants to the region who are not counted in C., D., or E.

Table 4-7 includes the assumption that some 40% of jobs supported by off-site visitor spending would be held by regional residents. That assumption takes into account the facts that much visitor spending goes for transportation and other services that may be based outside the region, and that jobs supported by visitor spending include indirect jobs, e.g., the manufacture of food or clothing purchased by visitors. Most of those indirect jobs would be outside the immediate region.

4.3 Fiscal Effects

Fiscal impacts consist of revenues generated by new development offset by new costs to local government incurred in order to support the new development and associated populations. New revenues can be estimated from new capital brought to Hawai‘i by project development and through visitor spending. New costs can be estimated as a share of the government spending needed to support Hawai‘i’s visitor and resident populations.

The Proposed Action will result in a cumulative net benefit – i.e., total benefits minus total costs – for the period 2014 to 2025 estimated as $163.4 million for the State of Hawai‘i and as $45.6 million for the City and County of Honolulu (in 2011 dollars). After full occupancy has been reached, the annual net benefit for the State will amount to $14.6 million, while the net benefit for the City and County will be about $6.6 million yearly.

4.3.1 Revenues

New revenues for the State of Hawai‘i come from (a) construction spending and construction-related workers’ incomes and spending, (b) cash flows with purchase or rental of real estate, and (c) other visitor spending. These are estimated for the major taxes used to collect such revenues in Tables 4-8 and 4-9. Additional property taxes for the City and County of Honolulu are estimated separately in Table 4-10.

Annual state construction-related revenues amount to nearly $10 million by 2020. Operations-related revenues for the state already exceed $10 million as of that year, and grow as spending by resort visitors increases.

Property tax revenue increases occur as land is redeveloped and new improvements are built. As Table 4-11 indicates, property tax revenues on new resort and residential units would amount to some $4.7 million in 2020, and would continue to increase until, after full absorption, they stabilize at approximately $8.3 million per year. The cumulative collections through 2025 would amount to $50.3 million.

Currently, the City and County of Honolulu collects about $12.4 million in real property taxes annually from residential and resort properties in the KNS region.[34] As of 2025, real property

[34] Estimated taxes compiled by Belt Collins Hawaii from Hawaii Information Service data (derived from City and County of Honolulu Real Property data), June 2012.

taxes on residential and resort units within the Proposed Action would amount to about $8.3 million of additional revenue annually, a major increase in funds available to support municipal services.

The property tax analysis is based on a detailed timetable for development of hotel and residential structures. Estimates of the increase in value of land are based on the new value of land developed, minus an average of values for land subject to redevelopment over time. The analysis omits the value of all new commercial structures and amenities, and increased value of the land they occupy.

Table 4-8: Government Revenues Associated with Construction

All figures are Millions of 2011 $s	Cumulative, through 2024	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Construction cost (1)	$769.9	$144.3	$72.5	$60.6	$67.9	$67.8	$64.3	$102.7	$55.3	$51.9	$49.1	$33.6
Construction-related Wages (2)	$473.0	$87.2	$44.4	$37.9	$42.0	$42.0	$40.0	$61.6	$34.5	$32.4	$30.5	$20.5
Excise Taxes To State (3)												
On Construction	$31.2	$5.8	$2.9	$2.5	$2.8	$2.7	$2.6	$4.2	$2.2	$2.1	$2.0	$1.4
On Spending by Workforce (4)	$12.0	$2.2	$1.1	$1.0	$1.1	$1.1	$1.0	$1.6	$0.9	$0.8	$0.8	$0.5
Excise Taxes to City and County of												
On Construction	$3.5	$0.6	$0.3	$0.3	$0.3	$0.3	$0.3	$0.5	$0.2	$0.2	$0.2	$0.2
On Spending by Workforce (4)	$1.3	$0.2	$0.1	$0.1	$0.1	$0.1	$0.1	$0.2	$0.1	$0.1	$0.1	$0.1
Income Taxes												
Corporate (5)	$1.3	$0.2	$0.1	$0.1	$0.1	$0.1	$0.1	$0.2	$0.1	$0.1	$0.1	$0.1
Personal (6)	$28.8	$5.3	$2.7	$2.3	$2.6	$2.6	$2.4	$3.8	$2.1	$2.0	$1.9	$1.3
Total Revenues from Construction Spending												
State of Hawaii	$73.3	$13.6	$6.9	$5.8	$6.5	$6.5	$6.2	$9.7	$5.3	$5.0	$4.7	$3.2
City and County of Honolulu	$4.8	$0.9	$0.5	$0.4	$0.4	$0.4	$0.4	$0.6	$0.3	$0.3	$0.3	$0.2

NOTES: Since occupancy is expected to be achieved in 2025, Belt Collins has treated 2024 as the last year of construction. Values are rounded, so totals may be slightly different than the sum of the values in the table.

1 Estimated by Belt Collins Hawaii, in millions of mid-2011 dollars.

2 From Table 4-2.

3 The State collects General Excise Tax (4%) and, on O'ahu, an additional tax for transit (0.5%). Act 247 of 2005 directs the State to retain 10% of the County surcharge for administrative costs. Hence the State share of excise taxes is 4.05%, while the City and County share is 0.45%.

4 Excise tax is calculated on disposable income, estimated as 62.6% of wages (from historical spending rates).

5 Corporate income tax estimated (from historical rates) as 0.17% of revenues (data from 2000).

6 Personal income tax estimated as 6.1% of taxable income (from 2005 data).

SOURCES:

DBEDT 2011, 2005; Hawaii State Department of Taxation, 2001, 2008

Table 4-9: Government Revenues Associated with Real Estate Purchases and Visitor Spending

All figures are Millions of 2011 $s	Cumulative, through 2025	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Conveyance Taxes	$5.1	$0.8	$0.5	$0.5	$0.5	$0.5	$0.4	$0.5	$0.4	$0.4	$0.4	$0.3
Taxes on Visitor Accommodations												
Transient Accommodations Tax (Hotel Condominiums and Visitors in Resort Residential Units)	$32.9	$0.8	$1.3	$1.8	$2.2	$2.7	$3.1	$3.6	$4.0	$4.3	$4.5	$4.6
Transient Occupancy Tax (Time Shares)	$16.3	$0.1	$0.5	$0.7	$0.9	$1.1	$1.3	$1.6	$1.9	$2.2	$2.8	$3.2
Taxes on Cash Flows from Visitor Spending												
Excise Taxes												
On Lodging (Visitors only)	$16.0	$0.4	$0.6	$0.9	$1.1	$1.3	$1.5	$1.7	$1.9	$2.1	$2.2	$2.2
On Other Visitor Spending	$17.7	$0.3	$0.5	$0.7	$1.0	$1.3	$1.5	$1.8	$2.1	$2.5	$2.9	$3.2
On On- and Off-Site Workers' Spending	$11.7	$0.1	$0.3	$0.4	$0.6	$0.8	$1.0	$1.2	$1.5	$1.7	$2.0	$2.2
Excise Tax Total	$45.5	$0.8	$1.4	$1.9	$2.6	$3.4	$4.0	$4.8	$5.6	$6.3	$7.0	$7.6
State of Hawai'i Share	$40.9	$0.7	$1.2	$1.7	$2.4	$3.0	$3.6	$4.3	$5.0	$5.7	$6.3	$6.9
City and County of Honolulu Share	$4.5	$0.1	$0.1	$0.2	$0.3	$0.3	$0.4	$0.5	$0.6	$0.6	$0.7	$0.8
Income Taxes												
On- and Off-Site Workers	$25.3	$0.3	$0.6	$0.8	$1.3	$1.7	$2.2	$2.7	$3.2	$3.7	$4.2	$4.7
State of Hawai'i Total	$120.6	$2.7	$4.0	$5.5	$7.2	$9.0	$10.7	$12.7	$14.4	$16.3	$18.2	$19.7
City and County of Honolulu Total	$4.5	$0.1	$0.1	$0.2	$0.3	$0.3	$0.4	$0.5	$0.6	$0.6	$0.7	$0.8

NOTES: All taxes estimated from current rates (excise at 4.5%; TAT at 9.25%; TOT at 7.25% of half of maintenance fee for period of occupancy; conveyance taxes at escalating rates depending on cost and whether buyer is a Hawai'i resident) and historic ratios between earnings or revenues and taxes. Excise tax on workers' income estimated for taxable disposable income. Property sale values and maintenance fees estimated by Belt Collins Hawaii based on information from TBR and review of comparable projects. Values are rounded, so totals may be slightly different than the sum of the values in the table.

Table 4-10: Increased Property Tax Revenues for the City and County of Honolulu, with Proposed Action

	2025 -- Full Absorption	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Land Redeveloped (acres)												
Annual	11	40	23	22	22	21	20	19	13	14	17	11
Cumulative	221	40	62	84	106	127	147	166	179	193	210	221
Value of Redevelopment (Mill $s) (1)												
Residential Construction	$441.0	$84.2	$130.8	$176.3	$210.7	$243.0	$275.0	$320.1	$357.6	$392.3	$422.9	$441.0
Residential Land	$586.8	$118.8	$182.0	$245.9	$309.5	$369.3	$429.9	$481.2	$516.7	$549.1	$577.6	$586.8
Hotel Construction	$175.9	$11.6	$23.1	$34.7	$59.3	$84.3	$107.4	$120.9	$134.4	$148.2	$163.3	$175.9
Hotel Land	$202.7	$9.3	$18.7	$28.0	$41.8	$55.7	$68.1	$84.6	$101.2	$124.0	$165.9	$202.7
Property Taxes (Mill $s)												
Annual Collections (new development built to date)												
Residential	$3.6	$0.7	$1.1	$1.5	$1.8	$2.1	$2.5	$2.8	$3.1	$3.3	$3.5	$3.6
Hotel, Resort	$4.7	$0.3	$0.5	$0.8	$1.3	$1.7	$2.2	$2.5	$2.9	$3.4	$4.1	$4.7
Cumulative Collections	$50.3	$1.0	$2.6	$4.8	$7.9	$11.8	$16.4	$21.8	$27.8	$34.4	$42.0	$50.3

NOTES: Land "redeveloped" is land that changes from existing use as golf or open space to hotel and residential, under or around new structures. Value of new development is taken from esti construction costs and review of land values for hotel and resort residential properties in KNS and Ko ‘Olina. Land values are net, i.e., the increase in land value, over average current value for properties at Turtle Bay Resort, with redevelopment. The analysis does not deal with commercial space and other amenities in the resort. It is a conservative estimate of new property values taxes, not a complete one. The numbers shown are rounded, so totals may differ slightly from the sum of the individual numbers in the table

(1) For particular years, the value is for development coming on market that year; for absorption, it is the value of the entire project.

4.3.2 Government Costs and Net Benefit

New development may increase costs to government by increasing demand for services, by relocating demand to areas where service delivery is difficult, or by creating demand for new facilities. For a resort, many of these costs can be estimated using average cost analysis. This analysis identifies on a per-person basis the amount that government agencies actually spend. Some costs are treated as for services only to residents; other costs benefit both residents and visitors. The per-person cost is derived by dividing the cost of services by the resident or de facto (residents and visitors actually in-state or on-island on an average day) population in the year the services are provided. This approach estimates new resort-related costs in terms of the number of new residents and visitors served.

The average cost approach does not address the question of whether a new development demands significant new facilities, i.e., situations in which the marginal cost of serving additional residents or visitors is much greater than the average cost. Input from public service agencies and the analysis in the remainder of this chapter suggest that new facilities would not be warranted to serve the new populations associated with the Proposed Action., i.e., that the average cost analysis provides a reasonable estimate of actual costs associated with the Proposed Action.

Table 4-11 provides an average cost analysis for the State of Hawai‘i, and Table 4-12 covers the average cost of services by the City and County of Honolulu, based on recent expenditure reports.

Table 4-11: Average Cost Analysis, State of Hawai'i

	FY 2009 spending ($1,000s)	Spending for residents or all?	Resident share	Visitor share
General expenditure, by function:				
General government	$597,210	All	$431.47	$431.47
Education	$3,362,707	Residents	$2,610.22	--
Public welfare	$2,119,481	Residents	$1,645.20	--
Health	$798,026	All	$576.56	$576.56
Highways	$442,421	All	$319.64	$319.64
Public safety	$435,414	All	$314.58	$314.58
Natural resources	$120,693	All	$87.20	$87.20
Culture and recreation	$110,404	All	$79.76	$79.76
Urban redevelopment, housing	179,819	Residents	$139.58	--
Economic development and assistance	$149,075	Residents	$115.72	--
Debt service	$401,722	All	$290.24	$290.24
Other and unallocable	$3,084	All	$2.23	$2.23
Total	$8,220,571	***Total Per Person***	$6,612	$2,102
		Adjusted to 2011	**$6,830**	**$2,171**

NOTES: Average cost is the cost of services delivered over a year's time, calculated per person, for resident or de facto population, depending on function. Some functions, such as highway maintenance, benefit both residents and visitors; for these the per-person share is estimated based on the de facto population. (The de facto population is the number of persons present on an average day, i.e., the average visitor census plus the number of residents actually in-state or, for the City and County of Honolulu, on the islands.) Spending is for the most recent year for which expenditures reported by function in Data Book (Table 9.19). The per-person spending totals are then adjusted in line with changes in the Consumer Price Index (3.29% from 2009 to 2011).

State of Hawaii Population, mid-2009:

Residents	1,288,285
De Facto	1,384,124

SOURCE: DBEDT, *State of Hawaii Data Book 2010; Quarterly Statistical and Economic Report, First Quarter, 2012*

Table 4-12: Average Cost Analysis, City and County of Honolulu

	FY 2009 spending ($1,000s)	Spending for Residents or All?	Resident share	Visitor share
General expenditure, by function:				
General government	$149,994	All	$151.91	$151.91
Public safety	$371,627	All	$376.37	$376.37
Highways	$16,781	All	$17.00	$17.00
Mass transit	$3,863	Residents	$4.04	$0.00
Miscellaneous	$218,130	All	$220.91	$220.91
Sanitation	$3,863	All	$3.91	$3.91
Health and human resources	$71,606	Residents	$74.93	$0.00
Culture and recreation	$73,087	All	$74.02	$74.02
Utilities and other enterprises	$27,758	All	$28.11	$28.11
Capital outlay	$330,581	Residents	$345.93	$0.00
Debt service	$185,164	All	$187.53	$187.53
Total	$1,452,454	***Total per person***	**$1,485**	**$1,060**

NOTES: Average cost calculated for resident or de facto population, depending on function. Some functions, such as road maintenance and public safety, benefit residents and visitors alike. Other functions benefit residents, and may benefit future visitors, but most recent year with expenditures reported by function in City's Consolidated Annual Financial Report.

City and County of Honolulu Population, mid-2010:

Residents	955,636
De Facto	987,406

SOURCES: DBEDT, State of Hawaii Data Book 2010; City and County of Honolulu, Consolidated Annual Financial Report for Fiscal Year 2011. Personal communication, Jan Nakamoto, State Data Center, July 2011.

Revenues would exceed project-related costs for both the state and county. Visitor-related and new resident-related costs to the State of Hawai‘i associated with the Proposed Action are estimated as totaling about $28 million through build-out – but revenues for the state would be more than $190 million over that time. Revenues would continue to exceed costs by a large margin in later years.

Similarly, the City and County of Honolulu would see revenues greater than costs throughout the project development period and afterwards. At build-out, the net new revenues would exceed $45 million. The Proposed Action would continue to generate additional revenues from property taxes.

After 2025, the State would continue to collect an estimated $19.7 million (2011 dollars) in taxes annually due to visitor spending at the resort, while the City and County would collect about $8.3 million annually from property taxes. (City and County excise tax revenues are dedicated to the mass transit project and are to be eliminated when project costs are covered.)

Table 4-13: Summary of Government Revenues and Costs, Proposed Action

	Cumulative, through 2025	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
State of Hawai'i													
Revenues (Mill. $s)	$193.9	$13.6	$9.6	$9.9	$12.0	$13.7	$15.2	$20.4	$18.0	$19.4	$21.0	$21.4	$19.7
Average cost, Visitors $2,171													
Average Census, Visitors staying at Resort	12,729	-	221	386	553	729	921	1,102	1,326	1,534	1,753	1,997	2,206
Visitor-Related Costs (Mill. $s)	$27.6	$0.0	$0.5	$0.8	$1.2	$1.6	$2.0	$2.4	$2.9	$3.3	$3.8	$4.3	$4.8
Average cost, Residents $6,830													
Full-time Resort Residents at Resort	416	-	12	19	26	31	35	40	44	48	51	54	55
Resident-Related Costs (Mill. $s)	$2.8	$0.0	$0.1	$0.1	$0.2	$0.2	$0.2	$0.3	$0.3	$0.3	$0.4	$0.4	$0.4
Total Costs	$30.5	$0.0	$0.6	$1.0	$1.4	$1.8	$2.2	$2.7	$3.2	$3.7	$4.2	$4.7	$5.2
Net Revenues > Costs	$163.4	$13.6	$9.0	$8.9	$10.6	$11.9	$13.0	$17.7	$14.8	$15.8	$16.8	$16.7	$14.6
City and County of Honolulu													
Revenues (Mill. $s)	$59.7	$0.9	$1.5	$2.1	$2.9	$3.8	$4.6	$5.7	$6.2	$6.9	$7.6	$8.5	$9.1
Average cost, Visitors $1,060													
Average Census, Visitors staying at Resort	12,729	-	221	386	553	729	921	1,102	1,326	1,534	1,753	1,997	2,206
Visitor-Related Costs (Mill. $s)	$13.5	$0.0	$0.2	$0.4	$0.6	$0.8	$1.0	$1.2	$1.4	$1.6	$1.9	$2.1	$2.3
Average cost, Residents $1,485													
Full-time Resort Residents at Resort	416		12	19	26	31	35	40	44	48	51	54	55
Resident-Related Costs (Mill. $s)	$0.6	$0.0	$0.0	$0.0	$0.0	$0.0	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1
Total Costs	$14.1	$0.0	$0.3	$0.4	$0.6	$0.8	$1.0	$1.2	$1.5	$1.7	$1.9	$2.2	$2.4
Net Revenues > Costs	$45.6	$0.9	$1.2	$1.7	$2.2	$2.9	$3.6	$4.5	$4.7	$5.2	$5.7	$6.3	$6.6

NOTES: See Tables 4-8 to 4-12. The values shown are rounded, so totals may differ slightly from the sum of the individual values in the table.

4.4 Social Impacts

4.4.1 Housing

The Proposed Action would address the regional housing problem in four ways:

- Affordable housing will be built for members of the local community to buy or lease;
- With more stable jobs in the region, more residents will want to, and be able to, set up their own households nearby; and
- Resort residential housing will supply mostly luxury market-price homes and condominiums that may appeal to upper income residents as well as visitors.
- Resort residential housing at Turtle Bay Resort could attract some of the visitors who would otherwise stay in illegal transient vacation rental units. By reducing demand from that group, the Proposed Action would tend to discourage illegal rentals, and hence encourage some of the region's landlords to make housing available for residents.

While community housing (and, to a lesser extent, resort housing) would respond to resident housing demand, new workforce incomes will tend to increase demand. Additional wages for operations-related workers would help them establish families and households of their own. Household formation occurs over time, as workers gain families and savings. It can be affected by economic conditions such as housing prices and mortgage rates.

Table 4-14 estimates the first two potential housing effects for the KNS region, as of project absorption. The regional estimate includes both on-site workers and a share of off-site workers whose jobs are supported by visitor spending. Based on surveys of resort workers in West Hawai'i conducted in the 1980s, new incomes appear sufficient, over time, to support new household formation for 15% to 30% of the regional resort workforce.[35]

The table suggests that the regional effect of the Proposed Action is limited and could be positive: new workforce housing creation within the project could be greater than new household formation. Also, the new community housing is expected to be built from the beginning of the construction period, while housing demand due to new operations jobs would grow over time, as working families save for new homes.

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[35] Research on population and housing effects of resort development has dealt mainly with the introduction of resorts in rural areas. The present case involves expansion, in an area where skilled resort workers are already present. There is no reason to expect resort expansion to draw a large body of workers from other areas, and to have large effects on housing when the new facilities open. (Also, the market study for the project calls for gradual development of facilities from year to year, not a one-time opening event.) The high estimates based on earlier research may consequently overestimate the extent to which resort expansion affects demand for housing.

The effect of increases in resort residential housing supply on regional housing demand and prices depends on many factors, and is not estimated here. It is expected to be positive, i.e., to increase local supply available to meet resident demand.

Table 4-14: Major Housing Effects Associated with Proposed Action, KNS Region

As of 2025	Proposed Action
New Operations-Related Jobs	
On-site	753
Other direct jobs, KNS region (1)	177
	930
Dependents supported by new KNS workforce (2)	965
Households supported by workforce	556
New household formation over time (3)	
Low estimate (15%)	83
High estimate (30%)	167
New community housing at TBR	160
Housing Impact (Demand for Units):	
Low Estimate	77
High Estimate	(7)

NOTES: On-site jobs estimated in Table 4-3; off-site jobs derived from Table 4-4.

(1) Other direct jobs estimated as 40% of direct and indirect workforce supported by off-resort spending.

(2) Dependency ratios from 2006-2010 Five-year estimates for KNS region:

Population in households	31,111
Workforce	15,275
Average household size	3.41

(3) New housing demand estimated as 15% to 30% of workforce households, based on studies of West Hawaii resorts.

SOURCE: American Community Survey. (www.census.gov)

4.4.2 Public Safety Services and Facilities

Future without Project (No Action Alternative)

For Fiscal Year 2011/2012, the City and County of Honolulu adopted budget allows for the following positions:

- Police: 1,484 patrol officers (about 1.56 per thousand persons in the island of O‘ahu); and
- Fire Protection: 1,018 fire operations positions (about 1.07 per thousand).

The ratio of positions to population provides a basis for estimating need for additional staffing as local populations rise.

Future with Proposed Action

The Proposed Action would account for regional population growth of about 3,157 persons (including both residents and visitors). To provide for that increase, some 4.9 police patrol officers and 3.4 fire operations positions could be needed (extrapolating from recent ratios).[36] That increase is within the growth that can reasonably be forecast given recent DPP expectations.

The population increase does not appear large enough to motivate construction of new public safety facilities.

Redevelopment of the resort would bring increased patrols by resort security. New roadways, park facilities and landscaping would remove large areas of brush from the TBR lands. New construction would be to current fire codes, reducing the risk of fire and increasing access to the entire resort. All of these factors would tend to reduce demand for public safety services due to new development.

4.4.3 Educational Facilities

Schools

The State Department of Education is expected to provide its own projections of demand for school services and facilities associated with the Proposed Action. The estimates in this section offer projections for the Proposed Action and the Development Alternatives based on Census data.

Future without Project (No Action Alternative)

The regional population is expected to grow slowly, so demand for schools would likely increase slightly over the next decades.

Proposed Action

The Proposed Action would affect several groups with school-age dependents. Some, but not all, would have an effect on schools:

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[36] The cost of increased fire protection and police protection might be estimated from current expenditures for salaries, overhead and patrol equipment. It is not calculated here, because it has already been estimated using the average cost approach (in Table 4-13).

- **Resort Residents:** New resort housing generates very little or no new public school student enrollment. Most such resort housing is occupied by part-time occupants. Full-time resort housing occupants tend not to have school-age children. They are unlikely to enroll in public schools the few children who live in resort homes.

- **Community Housing Residents:** Community housing at Turtle Bay is intended to serve the needs of existing regional residents, not to attract a new population. Some of those residents would vacate existing housing that then could house other families. Many would move from multi-generational homes, where they would not be so quickly replaced. The total number of households in the region would accordingly increase due to the development of community housing, but the increase would likely be a small fraction of the number of new homes built. The increase in the number of new public school students would similarly be small.

- **Workers in New Resort Jobs:** As estimated in Tables 4-3 and 4-4, operations jobs and visitor spending could increase the regional resident population. Dependents of such new resident workers could attend local schools.

Table 4-15 provides estimates of total regional new enrollment, based on the analysis of regional housing growth over time in Table 4-14. BCH suggests that the likely effect could fall near the midpoint between the low and high estimates.

Table 4-15: Potential New Public School Enrollment, Proposed Action, to 2025

	Proposed Action
New Community Housing	160
New Households Formed by Workers	
Low Estimate	83
High Estimate	167
Potential New K-12 Enrollment	
Low Estimate	49
High Estimate	123

NOTES: Enrollment estimated based on the 2010 ratio of households to Department of Education K through 12 students on O'ahu (37.6 students per 100 households). The low enrollment estimate counts, as generating student enrollment, only 30% of the new community housing units plus the low estimate of new households formed by workers as a new source of students. The high enrollment estimate counts all of the new community housing plus workers' household formation as sources of new students, and assumes that no double counting is involved in combining the two. In both cases, Resort Residential housing is not treated as a source of DOE students. Readers should note that all or nearly all the occupants of community housing are expected to be KNS region residents: this estimate follows standard practice for school impact studies but not the full set of assumptions used in earlier tables.
SOURCES: US Census; Hawai'i State Department of Education enrollment data posted in 2010.

The effect estimated here is regional, not confined to the immediately adjacent schools. It would occur over many years, not immediately. An increase of about 100 students (as compared to the current regional DOE enrollment of 4,826) would amount to about 2% of total enrollment, an amount that would likely not raise problems of capacity for regional schools. Consequently, even the high estimate does not indicate a significant effect on DOE schools.

4.4.4 Preschools

The recent American Community Survey for 2006 to 2010 counted 561 children enrolled in preschool among KNS residents, or 6.14 per 100 households.

Future without Project (No Action Alternative)

The regional population is expected to grow slowly, so demand for preschools would likely increase slightly over the next decades. As noted earlier, demand for preschools has decreased in recent years due to reduced state funding and tight family budgets. Access to preschool education is a theme of the education initiatives supported by the current state administration, so state funding could increase.

Proposed Action

With more resort jobs available, some local workers can avoid long commutes. Some young parents may rejoin the labor force, seeking part- or full-time work near home if they can combine work with child-care that meets their needs and standards.

The same analysis used for school enrollments can be made for preschools. Table 4-16 shows the new preschool enrollment associated with the Proposed Action to be modest. This analysis does not address the question of whether new resort employees would seek child-care facilities near the resort; the UA specifies establishment of such a center on or near the resort.

Table 4-16: Potential New Preschool Enrollment, Proposed Action, to 2025

	Proposed Action
New Community Housing	160
New Households Formed by Workers	
Low Estimate	83
High Estimate	167
Potential New Preschool Enrollment	
Low Estimate	8
High Estimate	20

SOURCE: U.S. Census, American Community Survey, 2006 through 2010.

4.4.5 Health Care

Future without Project (No Action Alternative)

A study published in 2003 reviewed both long-term demand trends and changes in technology and operations affecting usage of hospital beds. While increased demand was expected by 2010 and 2025, the report was "cautiously optimistic" about Hawai'i's ability to meet the population's need for acute and long-term care beds.[37] From 2001 through 2007, O'ahu had approximately 2,513 civilian acute care hospital beds, which were occupied about 67% of the time.[38] That number of beds corresponds to 2.7 beds per thousand persons (in the de facto population). However, the recent closure of a two-hospital corporation serving Honolulu and Leeward O'ahu has aroused new concerns.[39]

The City and County of Honolulu Emergency Medical Service staff currently includes 283.75 positions, or about 0.30 per thousand persons on O'ahu.[40]

Proposed Action

The regional population increase associated with the Proposed Action by 2025 – 951 regional residents and 2,206 visitors – might justify the addition of nine more beds (at historic occupancy levels) to the island's acute care inventory. The population increase associated with the Proposed Action might create demand for an EMS staff position by 2025.[41]

4.4.6 Recreational Opportunities

Resort Recreation

Future without Project (No Action Alternative)

If no further development occurs at Turtle Bay, both golf courses might remain open as 18-hole courses. Tennis and equestrian activities could be unchanged.

Proposed Action

With the Proposed Action, a new clubhouse and a new equestrian center would be built. The Fazio golf course would be redeveloped as part of an integrated 27-hole facility. With the onsite

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[37] Hawaii Health Information Corporation. "Forecasting Long-Term Care and Acute Care Bed Days in Hawaii: Projections to 2025." Posted at http://hawaii.gov/shpda/resources-publications/shtrend.pdf.

[38] DBEDT, *State of Hawai'i Data Book 2010,* Table 2.26.

[39] A bill to authorize revenue bonds (HB2345) to cover the debts of Hawaii Medical Center was considered in the 2012 State Legislature but was not passed by both chambers. Both island and Mainland corporations have expressed some interest in re-opening one or both of these hospitals.

[40] The estimate is based on the budget passed by the City Council for the current fiscal year.

[41] As noted before for public safety services, the cost of service to new populations due to the Proposed Action was estimated in the average cost analysis.

visitor and resort resident population increased by about 195%, demand for golf is likely to increase, and usage would increase. The increased demand could affect other courses as well. The Kahuku public course could attract a few more resort residents and visitors. With higher usage, and perhaps higher fees at Turtle Bay, golf tour operators serving the island as a whole would tend to send fewer golfers to Turtle Bay.

Beach and Ocean Activities

Future without Project (No Action Alternative)

With no further action, demand for beach and ocean access at the resort would likely not increase greatly. However, beach, ocean education and beach park maintenance would not be improved. An increase in usage of Kawela Bay is likely, since the site is gaining a reputation as a "secluded" beach where turtles can be seen. Access would not be improved, so most visitors would park along the edges of Kamehameha Highway and walk to the beach around the gate.

Proposed Action

The Proposed Action calls for establishment of parks at Kawela Bay, Turtle Bay, Kuilima Bay, and Kahuku Point, with a total of 12 public shoreline access points. These improvements would help residents and visitors spread along the coastline, rather than congregating near the hotel(s) because stalls at the new parks will reduce the need for beachgoers to park at the hotel. While beach usage would increase significantly with more hotel guests and resort residents, the easily accessible area for beachgoers would also increase. Higher and more consistent usage of these sites would occur. As City and County beach parks, the Kawela and Kuilima Point parks might be staffed by lifeguards, when City and County budgets permit. The resort's operators can be expected to help maintain these sites and the surrounding area, assuring they are kept clean and secure, and helping to lower risks of ocean safety incidents.[42]

Parks and other Recreation Sites

Future without Project (No Action Alternative)

In the future without project alternatives, resident and visitor usage of beach parks and other public recreation sites in the KNS region would probably increase slowly, in line with growth in the island resident and visitor populations. Park usage already creates problems for circulation, especially at times of high surf and surf competitions.

Proposed Action

With the development of new parks at Kawela Bay and the Kahuku Point coast open to the public, Turtle Bay Resort would draw off some of the visitor traffic now clogging the roadside

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[42] No claim is made here that the resort would staff the parks with lifeguards or other full-time staff, only that the presence of beachgoers, surf school staff and/or resort staff, would lower the risk of accidents and harm in ocean sports and that resort operators would be interested in supplementing City and County maintenance activities.

near Laniākea Beach and North Shore surf sites. However, the reduction and how much it might affect the overall traffic and pedestrian congestion issue are difficult to forecast.

New parks and pathways, along with improved access to beach areas, will make walking, jogging and bicycling more appealing for both resort visitors and their neighbors. Much as the new bikeway between Lāʻie and Kahuku encourages walking and sociability for the residents of those towns, so new trails and resources at the resort can encourage outdoor recreation and social interaction for resort-goers and residents, especially if new trails extend the length of the resort.

4.4.7 Geographic Extent of Effects

On-Site Effects

Construction work would bring a new workforce to the resort by 2015. If, as anticipated, new hotel and residential construction proceeds incrementally in response to market demand, construction would continue through 2024, with an average daytime on-site construction workforce of approximately 237 persons. (After 2024, some work to maintain and repair facilities would likely occur. The timing and extent of such work would depend on design and construction choices still to be made, and are not analyzed herein.)

New operations jobs would be created by 2015 and increase in numbers along with the increase in hotel and resort residential units. After build-out, the new on-site workforce would be about 753 workers, in addition to the current Turtle Bay workforce. The total operations workforce for the resort (including existing jobs) would be about 1,343 workers.

As reported earlier, some resort workers are concerned that new properties at Turtle Bay Resort would be non-union, and that expansion would result in increased workloads for both current and future staff. They ask whether the new hotel properties would be "full-service." Several factors bear on this concern:

- Because the Proposed Action consists of a resort expansion over several years, not a whole new resort created all at once (as the Waikoloa Hilton was), workforce growth would occur regularly over about ten years.

- Time share properties are sometimes thought to demand fewer staff per room for housekeeping and other departments. This may have been true of time share properties in areas such as Waikīkī in the past. Time shares at Turtle Bay will be staffed to support a relaxing resort experience for guests. Also, time shares would support an early marketing staff as well as staff on-site attending to guests.[43]

[43] Time share marketing staff may be on-site, off-site or even out of state. Consequently, this employment effect is not included in the analysis.

- Turtle Bay is an isolated resort, so the operator and on-site subcontractors provide a wide range of services and amenities for guests. With more hotel units and housing on-site, demand for resort services would increase.

- Successful expansion would depend on maintaining and enhancing the resort's reputation. New hotel properties would likely be more upscale than the existing hotel, and stand-alone resort residential units could be comparable to the Ocean Villas and other properties in Kapalua and Wailea on Maui. The operators would need to maintain or improve customer service throughout the resort.

- TBR is considering fair employment rules that could bind future operators to provide jobs with wage scales commensurate with similar jobs in the area.

In light of these factors, it seems likely that the expansion would bring significant job growth and moderately high staffing levels. In 2010, Maui Island had 0.89 accommodations jobs per visitor unit.[44] For the Proposed Action, the accommodations staffing for the new properties is estimated as 0.82 accommodations jobs per hotel unit.[45] This is higher than the current ratio for the Turtle Bay Hotel and Ocean Villas (about 0.70 to 0.75 accommodations jobs per unit).

Both time share and condominium hotel properties are likely to achieve high occupancy levels, much like those currently experienced at Turtle Bay. Time share properties are especially likely to have continuously high occupancy. Time share buyers have already invested in their units, and operators can rent out unsold weeks. With high occupancies would come consistent employment – more full-time jobs, fewer on-call and perhaps fewer part-time jobs.

The Proposed Action (and the Conservation Partner Alternative) surround the existing hotel and residential areas with new properties designed to attract today's visitors and second-home buyers. The Proposed Action increases the population on-site and hence demand for recreational resources. It would refurbish those resources and greatly improve access to beachfront areas. The number of golf holes would actually decrease from 36 to 27. New restaurants and other amenities may attract new day visitors, but this group is not being targeted to increase greatly.

The Gathering Place, combining retail, food and cultural amenities, could draw new day visitors to the resort. Some would spend a short time at the resort; others could combine a visit to the Gathering Place with a half- or full-day trip to the resort beaches. Day visitors' numbers and time on the property could climb during special events. The Gathering Place has been conceived as serving resort guests and residents of the region, not as a new draw attracting visitors from outside the KNS region.

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[44] Data available from series maintained on DLIR and DBEDT websites: (http://www.hiwi.org/gsipub/index.asp?docid=421; http://hawaii.gov/dbedt/info/visitor-stats/visitor-plant/2010VPI.pdf). Unit count includes visitor condominiums as well as hotels. Job count is for accommodations only, i.e., only part of the workforce at hotels.

[45] This estimate was based on occupancy and staffing at other hotels viewed as offering comparable experiences, not on the global comparison mentioned here. See Appendix B for further discussion.

Development of a park at Kawela Bay would affect usage of this resource. The bay is already well known to area residents. It is mentioned in Internet reviews as "secluded," so improved access would both allow more users to reach the beach easily and reduce its status as a mysterious find. However, the beauty of the site, calm waters, and wildlife would likely attract many more beachgoers and ocean users, so recreational use would increase significantly.

Effects on the existing properties, owners and residents at Turtle Bay depend first on the fact of new development and secondly on its extent.

First of all, construction would likely bring some traffic, noise, and dust effects. These would be highly controlled. Contractors would be subject to State and City and County regulations limiting these effects. Moreover, the owners of the resort would presumably seek to minimize construction effects on existing properties in the resort, assuring operating income through the construction period. Also, the proposed construction schedule, involving incremental development over several years, points to a process that could restrict construction to delimited areas at any one time.

Construction is expected to last over some 11 years for the Proposed Action, and much longer for the Full Build-Out Alternative. Hotel construction and ongoing operations (at Turtle Bay Hotel and new hotels in the resort) can be successfully combined. This has been evident at the Maui Marriott at Ka'anapali, where workers transformed the concrete and steel structure floor by floor over several years from a traditional hotel to a time share property. The hotel retained high occupancy levels despite construction impacts.

The Turtle Bay Hotel would become the central property of a larger destination resort. The owner would likely maintain and upgrade it as part of the process of attracting upscale clients to the resort as a whole. While new resort properties may be more exclusive in reputation and achieve higher returns, their success would depend on the entire resort. Again, new amenities and activities would serve Turtle Bay Hotel guests as well as new visitors.

The Kuilima Estates condominiums would be affected by additional factors. The overall effect is not entirely clear:

- With development of new hotels near the shoreline, persons in the condominium units facing the ocean would see more buildings and more resort landscaping. In the case of the Proposed Action, the change is likely to involve an increase of visible landscaping (as opposed to ironwoods and brush at the far side of the Fazio golf course) as much as an increase in visible structures. Current plans call for structures to be spread out within the areas designated for hotel development, and for extensive landscaping. (Kuilima Estates units now have golf course or interior views, not unobstructed ocean views.)

- The Fazio golf course is expected to be refurbished as a nine-hole course. The published concept plan for the Proposed Action shows the entire Fazio Course area as continuing to be a golf course (rather than part being a golf course, and part being used simply as open space). A less cluttered course with appropriate landscaping would result in an improved view amenity for many units with views on and over the golf course.

- Increased activity nearby and the convenience of shopping at the Gathering Place and Farmer's Market would appeal to many residents, owners and renters.

Some property owners are concerned that the Proposed Action could result in lower values for some or many units in Kuilima Estates. BCH expects that this would not occur, so long as (a) the resort developer takes steps to ensure that visual effects of new development bring attention to the landscaping and open space in the resort and (b) the condominium owners maintain their properties and common areas. The resort owners' enthusiasm for the "Tomorrow's Ahupua'a" concept and acceptance of the role of steward for the Turtle Bay lands suggest that the redevelopment would enhance, rather than lower, the value of private property within the bounds of the resort.

The resort's neighbors, both in Kuilima Estates and outside the TBR lands, could benefit from improved access to beaches, paths and landscaping with redevelopment. Residents of homes along Kawela Bay would see increased recreational use of the bay, and hence a loss of the feeling of seclusion in their neighborhood.

Regional Effects

Regional effects follow largely from changes in employment at the resort, in off-site employment supported by visitor spending, and in the resort's contribution to regional traffic congestion. The last issue is analyzed in a separate study for the SEIS. Employment-related issues must be considered in light of (a) the quantity and quality of new jobs, (b) whether the regional population is able to take new jobs on-site and nearby, and (c) implications for housing, public facilities and community life. The first two issues are discussed in this section, while the last is discussed in relation to particular facilities and communities.

Some 753 new operations jobs would be created at the resort as of build-out by 2025. Additional jobs in the region would be due to off-site visitor spending and to the indirect and induced effects of operations employment. The off-site total is estimated as approximately 443 new off-site jobs island-wide, with a regional total of 177 off-site jobs.

The new jobs would likely be in a range of industries supporting resort facilities and activities. Similar jobs at the resort have been described in interviews as the best available in the KNS area, since few employers offer salaries, benefits, and job security found at a unionized resort. Island-wide, the average annual wage for the combined industries is approximately $22,850[46]. Resort workers at Turtle Bay gain union wages and substantial benefits, and many receive tips, over and above their wages.

The region's workforce can supply workers for both on- and off-site jobs. In addition to the 1,120 persons estimated as unemployed, the local high schools average more than 300 students in their senior class. The local school-leaving population would be far larger than the number of new jobs created annually. Many of these young adults would seek further education and jobs

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[46] Wages from "hotel" and "food and beverage" jobs combined, based on 2009 data adjusted to 2011 dollars. Source is State Department of Labor and Industrial Relations, *Employment and Payrolls in Hawaii, 2009*.

elsewhere. Still, an increase in jobs in the region would offer them the opportunity to stay near their homes – to choose among nearby jobs, long-distance commuting, and relocation to urban areas. In effect, by increasing local demand for workers, resort expansion would benefit the region as a whole.

The anticipated development schedule for the resort involves building and opening increments over time. This gradual approach would help to support local access to jobs. Sudden creation of a large number of jobs would be more likely to result in hires from outside the region and off-island.

Establishment of a farmers' market on-site and new demand for local foods in resort restaurants and kitchens would help support regional agriculture. It is not clear how large an effect is involved, and any growth in local production would also be due to landowners' efforts to support local farms and to the overall growth of the island market for fresh foods.

The new visitors and employees brought by the Proposed Action will contribute to regional traffic. See the Traffic Impact Assessment Report in the SEIS for further detail on the project's contribution to regional congestion and on traffic management strategies.

As indicated in Table 4-14, the contribution of the Proposed Action to the resident housing stock will be of immediate benefit, and will likely be larger than the new demand generated over time by households supported by project-related jobs.

Little or no impact on property taxes would occur for two reasons. First, Real Property assessors typically separate new developments from existing ones as separate "neighborhoods," and value them separately. Next, while increases in resident and resort housing stock could help to counter the trend towards increased prices (and hence taxes), price effects are felt throughout the island market, of which Turtle Bay and the KNS region are only a small part.

Island and Statewide Effects

For many decades, Hawai'i leaders have seen the visitor industry as the engine of the local economy, and visitor industry expansion as occurring mainly on the Neighbor Islands. The latter trend has been inflected by resort development at Ko 'Olina. Large new time share projects have succeeded there in recent years. New development at Turtle Bay Resort would similarly offer visitors a resort experience on O'ahu but away from Waikīkī. Continued tourism development is anticipated in both state and county planning projections.

The fiscal analysis shows that all the development alternatives generate new cash flows for the state and county. New revenues would far exceed average cost effects. Consequently, major government spending on infrastructure or public facilities for the region could be justified as funded by regional growth.

4.5 Quality of Life and Community Cohesion

KNS stakeholders interviewed for this study saw their region positively, despite serious traffic congestion and limited job opportunities. None spoke of the region as needing major social changes or community organizing.

Factors affecting quality of life throughout the region include:

- Employment and incomes for residents, both at the resort and in the surrounding region;
- Housing for members of the community;
- Changes in traffic patterns and congestion;
- Increased child care opportunities, aimed to meet the needs of resort workers;
- Reduced commuting, allowing residents more time for their families and for community involvement;
- New support for regional activities and causes from the residents and operators of the resort; and
- Resources and amenities at the resort including access to beach parks and new retail outlets.

If new job growth in the region were concentrated in Lāʻie, in facilities linked to the Church of Jesus Christ of Latter-Day Saints, there would be limited employment opportunities for the rest of the region and little pressure to maintain or increase wages other than the existing union contracts in force at Turtle Bay. Due to incremental regional population growth, long-distance commuting to other parts of Oʻahu would likely increase in the absence of new jobs at Turtle Bay Resort.

Trends associated with the Proposed Action affecting local community life include regional employment growth (and hence presumably less commuting), new housing being developed for local residents, an increase in resort and parks resources, along with increases in both visitors and part-time residents, and the spending in the local economy that would accompany them.

The Proposed Action's impacts on traffic congestion are assessed in a separate technical study, and not considered further here.

With new jobs and income associated with the Proposed Action spread throughout the KNS region by 2025, the project would have beneficial economic impacts and could help local communities to draw on more of the time and energy of residents for community activities than would be possible in the No Action future. The proposed new community housing area would

increase workforce housing in the immediate area.[47] The impact on resident housing would be positive or absent: the Proposed Action includes much more resident housing than would likely be demanded as a result of job project-related job growth.

The new visitor and part-time resident populations based at the resort would contribute to the region's economy as well as its traffic. Development of the commercial areas and cultural attractions at the Gathering Place would tend to increase the amount of their time spent at the resort, not on the road.

Some full-time resort residents could become active members of the larger community. Their involvement would depend on many factors. Resort residents in other parts of Hawai'i include local benefactors for community institutions along with some notable opponents of new development. Others – probably the large majority of resort homeowners – have little to do with groups and issues outside the boundaries of their home resort. Their consumer behavior would help to support local retailers, encouraging them to stock more items for affluent residents, not just for day visitors.

TBR is developing a non-profit Turtle Bay Foundation to address needs of the community. Future operators and homeowners would, as participants in a master resort association, contribute to the foundation.

Turtle Bay already has an important role in the lives of members of the KNS regional community. With expansion, the resort would also offer a greater range of retail, service and cultural venues for regional residents. Plans for the Gathering Plans and Farmers' Market and for cultural activities are intended to address residents' needs, not just those of short-term visitors.

More resort guests would seek to use beach and ocean resources than now – but access to such resources would greatly improve. Also, many new visitors at Hawai'i resorts make little use of ocean resources. Some stay at the resort pool; others walk the beach, but do not venture far into the ocean. Consequently, much of the increase in resort visitor numbers with the Proposed Action would be far smaller at the beaches and in the ocean than within the hotels.

4.6 Secondary and Cumulative Impacts of the Proposed Action

In an environmental impact statement, it is important to cover both direct and secondary or cumulative impacts. Secondary and cumulative impacts arise from the interaction of changes due to a project with the existing and expected context. The socio-economic analysis covers all of these effects by considering the existing resort along with proposed new development, and by identifying effects in the regional, island and state contexts.

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[47] This statement follows from (a) assurances by TBR that the community housing would be priced to meet the needs of local workers, not just to meet government pricing rules, and (b) the fact that jobs at TBR have stood out in the region as offering stable employment and, in most cases, excellent benefits.

A major question is whether new developments will have a cumulative impact that overshadows the impact of any one development. In the KNS region, the TBR and Envision Lāʻie expansions concentrate new development in a fairly small area. They seem more complementary than likely to have reinforcing impacts. The Lāʻie development would increase enrollments at BYUH and workforce housing for the Lāʻie community. Again, the hotel in the Lāʻie project would not be a resort but an amenity supporting BYUH and the PCC. It would have limited amenities and would likely serve a different market than the existing and proposed Turtle Bay Resort hotels.

These two projects should not have significant cumulative effects. They both would address residents' demand for housing – but the demand for housing at reasonable prices is great, and the two projects would encourage workers to live near their work sites, reducing highway commutes. When and if the Envision Lāʻie project's housing is approved and built out, it could reduce local demand for workforce housing appreciably. However, that project is designed to serve the Lāʻie community, not provide housing to attract others to the region or address the problems of Kahuku and the North Shore.

Lāʻie and Kahuku are currently the largest communities in the KNS region. Even with much new housing in the two communities, they would remain distinct both geographically and economically. The development of one or two community housing increments at Turtle Bay Resort would not change the "country" appearance of the region.

The Proposed Action may have an important secondary impact on the regional housing supply. With new resort housing available, many vacationers will be drawn to units at the resort, rather than to illegal transient vacation rentals. Demand for the illegal units will be reduced, and some of these will become available for rental at rates that residents can afford.

5 Socio-Economic Effects of ~~Development~~ Alternatives

For this report, the effects of the Proposed Action and each development alternative are quantified both over the period through 2025, and over the period leading to full occupancy for each alternative. (Full occupancy dates range from 2022 for the Conservation Partner alternative, to 2053 for the Full Build-Out alternative.) The No Action alternative is considered in this chapter, but not shown in tables where a No Action column would simply show no impacts.

The analysis in this chapter follows the same organization as in the last chapter. To compare operations and fiscal effects of the Development Alternatives, calculations are shown for development through 2025 – i.e., Full Absorption for the Proposed Action and the Resort Residential Alternative, and shortly after Full Absorption for the Community Partner Alternative -- and for the actual year of Full Absorption.

Table 5-1 compares the construction schedules for the four alternatives to 2025. It shows that, while the Full-Build Out alternative will over time involve far more hotel and resort residential units than the Proposed Action, fewer units would be built by 2025. (The No Action alternative involves no new construction, so it is not listed in Table 5-1.)

Table 5-1: Construction Plans, Development Alternatives

	Action and Alternatives			
	Proposed Action	**Full Build-out**	**Resort Residential**	**Conservation Partner**
Through 2025				
Hotel units	625	592	0	440
Residential Units				
Resort Residential	590	468	454	252
Community Residential	160	90	46	48
Build-out year	*2024*	*2052*	*2024*	*2021*

NOTE: When completed, the Full Build-Out Alternative would include 2,500 hotel units, 910 resort residential units, and 90 community residential units. Development schedule estimated by TBR.

5.1 Employment and Wages

5.1.1 Construction Employment and Wages

In Table 5-2, construction spending, employment and wages are shown for the entire construction period for each of the development alternatives. The annual average on-site construction workforce provides a point of comparison among the alternatives. While the Full Build-Out Alternative, when finished, involves far more construction than the other alternatives,

the Proposed Action brings the highest average annual construction workforce, simply because the larger project could only be built over a very long time.

Table 5-2: Construction-Related Employment and Wages, Proposed Action and Development Alternatives

	Proposed Action	Full Build-Out	Resort Residential	Conservation Partner
Construction Spending (million, 2011 $s)				
Infrastructure	$148.5	$215.1	$120.0	$87.8
Buildings	$324.4	$1,138.6	$4.5	$167.3
Single Family	$297.0	$16.2	$304.1	$115.1
Total	$769.9	$1,369.9	$428.5	$370.2
Direct Construction Workforce				
Infrastructure	564	636	456	334
Buildings	1,363	4,782	19	702
Single Family	1,336	73	1,368	518
Total	3,263	5,491	1,843	1,554
On-site Const. workers	2,611	4,393	1,474	1,243
Construction period (yrs.)	11	39	11	8
Average annual on-site FTE	237	113	134	155
Indirect and Induced Jobs	5,482	9,225	3,096	2,611
Wages (million, 2011 $s)				
Direct	$225.3	$379.1	$127.3	$107.3
Indirect and Induced	$247.7	$416.8	$267.2	$118.0
Total	$473.0	$795.9	$394.4	$225.3

NOTE: The values shown are rounded, so totals may differ slightly from the sum of the individual values in the table.
SOURCES: See Tables 4-2, 5-1.

5.1.2 Operations Employment and Wages

The next two tables compare the long-term workforces associated with the development alternatives. Both 2025 and full-occupancy estimates are provided. As of 2025, the Proposed Action would bring the largest operations workforce – but the Full Build-Out would involve far more workers, both on-site and off-, as its visitor numbers and spending grow. The Resort Residential Alternative stands out as generating only modest numbers of new jobs. Moreover, the Resort Residential Alternative would support very few off-site jobs through visitor spending.

Table 5-3: On-Site Employment and Wage Impacts, Proposed Action and Development Alternatives

	Proposed Action	Full Build-Out	Resort Residential	Conservation Partner
As of 2025				
Operations-Related Workers				
Direct Workers	753	530	48	469
Indirect + Induced Workers	785	559	43	494
Total	1,539	1,089	91	963
Wages (Million 2011 $s)				
Direct Workers	$23.8	$16.8	$1.6	$14.8
Indirect and Induced Workers	$35.5	$25.2	$1.9	$18.5
Total	$59.2	$42.1	$3.5	$33.3
After Full Absorption				
Estimated Absorption	*2025*	*2053*	*2025*	*2022*
Operations-Related Workers				
Direct Workers	753	2,240	48	469
Indirect + Induced Workers	785	2,359	43	494
Total	1,539	4,598	91	963
Wages (Million 2011 $s)				
Direct Workers	$23.8	$71.1	$1.6	$14.8
Indirect and Induced Workers	$35.5	$106.6	$1.9	$18.5
Total	$59.2	$177.6	$3.5	$33.3

NOTE: The values shown are rounded, so totals may differ slightly from the sum of the individual values in the table.
SOURCES: See Tables 4-3, 5-1.

Table 5-4: Off-Site Employment and Wage Impacts Associated with Visitor Spending, Proposed Action and Development Alternatives

	Off-site Employment from Visitor Spending			
	Proposed Action	Full Build-Out	Resort Residential	Conservation Partner
As of 2025				
Visitors Staying in New Units				
Total	2,206	2,202	483	1,477
Adjusted total, spending	1,862	1,793	242	1,376
Spending, Non-lodging				
Per person per day	$104.73	$89.92	$132.24	$119.01
Annual (Million $s)	$71.2	$49.7	$11.7	$59.8
Jobs from Visitor Spending				
Total (Direct and Indirect)	765	534	125	643
minus On-site (DII)	322	261	91	240
Off-site (DI)	443	273	34	402
Regional Share (40%)	177	109	14	161
	-			
Wages, Off-site (Million $s)	$18.4	$11.3	$1.4	$16.7
Regional Share (40%)	$7.4	$4.5	$0.6	$6.7
After Full Absorption	***2025***	***2053***	***2025***	***2022***
Visitors Staying in New Units				
Total	2,206	5,968	483	1,477
Adjusted total, spending	1,862	5,669	242	1,376
Spending, Non-lodging				
Per person per day	$104.73	$89.92	$132.24	$119.01
Annual (Million $s)	$71.2	$189.3	$11.7	$59.8
Jobs from Visitor Spending				
Total (Direct and Indirect)	765	2,035	125	643
minus On-site (DII)	322	1,103	91	240
Off-site (DI)	443	933	34	402
Regional Share (40%)	177	373	14	161
Wages, Off-site (Million $s)	$18.4	$38.7	$1.4	$16.7
Regional Share (40%)	$7.4	$15.5	$0.6	$6.7

NOTES: See Table 4-4 for approach. Non-lodging visitor spending estimated for the action and alternatives as follows:

	Action	*Full Build-out*	*Res.Res.*	*Cons. Part.*
Relation to average spending	99%	85%	125%	113%
Per-person per day, non-lodging spending	$104.73	$89.92	$132.24	$119.01

The regional share estimate was developed by Belt Collins Hawaii LLC on the basis of visitor spending patterns. The values shown are rounded, so totals may differ slightly from the sum of the individual values in the table.

5.2 Population Growth and Distribution

5.2.1 Population at the Resort

By 2025, the development alternatives would result in quite distinct on-site populations. At that time, the Full Build-Out Alternative would support a population much like that of the Proposed Action: the difference between the two emerges as Full Build-Out construction continues until 2052, as shown in Table 5-5. The Resort Residential Alternative would bring the smallest new population. With this alternative, the existing resort's population would account for two-thirds of the people on-site. Finally, the Conservation Partner Alternative would bring a smaller on-site population than the Proposed Action. However, that alternative concentrates the population in the central section of the property, so the density would be similar in that area.

5.2.2 Population Effects throughout the KNS Region

Table 5-6 applies to the development alternatives the assumptions developed to estimate the regional population for the Proposed Action. Again, the Resort Residential Alternative stands out as generating smaller visitor and employee populations.

The Full Build-Out Alternative regional population would continue to grow with further development until after 2050. While the regional population associated with that alternative after build-out can be calculated, its share of the regional population cannot, since no regional projections extend so far into the future.

Table 5-5: New On-Site Population, Proposed Action and Development Alternatives

	Existing Resort (No Action Alt.)	New Daytime Population with			
		Proposed Action	Full Build-out	Resort Residential	Conservation Partner
As of 2025					
Hotel , Ocean Villa guests	638	1,139	1,291	-	957
Resort Residential (including Kuilima Estates)					
FT Residents	167	41	52	43	24
PT residents, visitors	146	516	334	362	151
Community Residential		479	269	138	144
Day Visitors	96	180	190	161	173
Operations workforce	439	561	530	34	350
Construction workforce	-	-	127	-	-
Subtotal	1,485	2,916	2,795	737	1,798
Total at Resort (Combined)	1,485	4,401	4,280	2,223	3,284
Existing share of Combined Total	100%	34%	35%	67%	45%
After Absorption					
Year		*2025*	*2053*	*2025*	*2022*
Hotel , Ocean Villa guests	638	1,139	5,370	-	957
Resort Residential					
FT Residents	167	41	94	43	24
PT residents, visitors	146	516	599	362	151
Community Residential		479	269	138	144
Day Visitors	96	180	323	161	173
Operations workforce	439	561	2,240	34	350
Construction workforce	-	-	-	-	-
Subtotal	1,485	2,916	8,894	737	1,798
Total at Resort (Combined)	1,485	4,401	10,380	2,223	3,284
Existing share of Combined Total	100%	34%	14%	67%	45%

NOTES: Weekday state holiday midday population estimated. Only construction workers involved in new construction (rather than renovations) are included. The values shown are rounded, so totals may differ slightly from the sum of the individual values in the table.
SOURCES: See Table 4-6.

Table 5-6: Regional Population Associated with Proposed Action and Development Alternatives, 2025

all figures are persons, year 2025	*Action and Alternatives* Proposed Action	Full Build-out	Resort Residential	Conservation Partner
Resident Population Groups (Islandwide)				
A. TBR Resort Recreation Residents	55	70	43	24
B. TBR Community Housing Residents	638	359	138	144
C. Direct Operations Workforce Households	1,613	1,135	102	1,004
Indirect and Induced Operations				
D. Workforce Households (islandwide)	896	1,196	92	1,058
E. Off-Site Workforce Households	505	584	74	862
Total (assuming unduplicated counts)	3,707	3,344	448	3,090
Potential New Regional Resident Population				
A. 100% of group	55	70	43	24
B. 30% of group	192	108	41	43
C. 20% of group	323	227	20	201
D. 20% of group	179	239	18	212
E. 40% of group	202	234	30	345
Total	951	877	152	824
Share of Projected Regional Pop. Increase	36.7%	33.9%	5.9%	31.8%
Regional New De Facto Population Change				
Regional Resident Population	951	877	152	824
New TBR Visitor and Part-time Population	2,206	2,202	483	1,477
Total	3,157	3,079	635	2,301

NOTES: The values shown are rounded, so totals may differ slightly from the sum of the individual values in the table. On completion (as of 2053), the Full Build-Out Alternative would involve a Potential New Regional Resident Population of 3,000. The Regional De Facto Population Change associated with that alternative would climb to 8,968.
SOURCES: See Tables 4-7, 5-4.

5.3 Fiscal Effects

5.3.1 Revenues

Tables 5-7 through 5-9 estimate government revenues due to construction, sales and operations, and property values with development. They show significant revenue flows for both the State of Hawai‘i and the City and County of Honolulu with development. No change to revenues or costs has been projected for the No Action alternative future.

5.3.2 Costs

The average cost analysis used in the last chapter can be applied for all the development alternatives. Table 5-10 shows the net revenue (i.e., amount of revenues in excess of costs). The ratio of revenues to costs by 2025 is positive for all development alternatives. As of that point, the net revenues for the City and County of Honolulu are largest with the Proposed Action. Over time, the additional development in the Full Build-Out Alternative would make the return from that alternative the highest for both levels of government.

Table 5-7: Government Revenues Associated with Construction, Proposed Action and Development Alternatives

	Cumulative, through Build-out			
All figures are Millions of 2011 $s	**Proposed Action**	**Full Build-out**	**Resort Residential**	**Conservation Partner**
Construction cost (1)	$769.9	$1,369.9	$428.5	$370.2
Construction-related Wages (2)	$473.0	$795.9	$394.4	$225.3
Excise Taxes To State (3)				
On Construction	$31.2	$53.5	$17.4	$15.0
On Spending by Workforce (4)	$12.0	$20.2	$10.0	$5.7
Excise Taxes to City and County				
On Construction	$3.5	$5.9	$1.9	$1.7
On Spending by Workforce (4)	$1.3	$2.2	$1.1	$0.6
Income Taxes				
Corporate (5)	$1.3	$2.2	$0.7	$0.6
Personal (6)	$28.8	$48.5	$24.0	$13.7
Total Revenues from Construction Spending				
State of Hawaii	$73.3	$124.5	$52.1	$35.1
City and County of Honolulu	$4.8	$8.2	$3.0	$2.3

NOTE: The values shown are rounded, so totals may differ slightly from the sum of the individual values in the table.
SOURCES: See Table 4-8.

Table 5-8: Government Revenues Associated with Visitor Spending, Proposed Action and Development Alternatives

All figures are Millions of 2011 $s	Proposed Action	Cumulative Full Build-out	Cumulative Resort Residential	Cumulative Conservation Partner
Through 2025				
Conveyance Taxes	$5.1	$2.4	$9.7	$1.9
Taxes on Visitor Accommodations				
Transient Accommodations Tax (Hotel Condominiums and Visitors in Resort Residential Units)	$32.9	$18.1	$23.2	$26.3
Transient Occupancy Tax (Time Shares)	$16.3	$3.7	$0.0	$6.6
Taxes on Cash Flows from Visitor Spending				
Excise Taxes				
On Lodging (Visitors only)	$16.0	$8.8	$11.3	$12.8
On Other Visitor Spending	$17.7	$11.6	$6.0	$21.5
On On- and Off-Site Workers' Spending	$11.7	$7.3	$1.6	$11.9
Excise Tax Total	$45.5	$27.7	$19.0	$46.2
State of Hawai'i Share	*$40.9*	*$25.0*	*$17.1*	*$41.6*
City and County of Honolulu Share	*$4.5*	*$2.8*	*$1.1*	*$4.6*
Income Taxes				
On- and Off-Site Workers	$25.3	$15.9	$3.5	$25.7
State of Hawai'i Total	$120.6	$65.0	$56.1	$102.2
City and County of Honolulu Total	$4.5	$2.8	$1.1	$4.6
Through Full Absorption *Year:*	***2025***	***2053***	***2025***	***2022***
Conveyance Taxes	$5.1	$7.1	$9.7	$1.9
Taxes on Visitor Accommodations				
Transient Accommodations Tax (Hotel Condominiums and Visitors in Resort Residential Units)	$32.9	$193.3	$13.2	$17.3
Transient Occupancy Tax (Time Shares)	$16.3	$41.6	$0.0	$3.9
Taxes on Cash Flows from Visitor Spending				
Excise Taxes				
On Lodging (Visitors only)	$16.0	$94.0	$6.4	$8.4
On Other Visitor Spending	$17.7	$173.0	$3.4	$13.5
On On- and Off-Site Workers' Spending	$11.7	$121.8	$0.9	$7.4
Excise Tax Total	$45.5	$388.8	$10.7	$29.3
State of Hawai'i Share	*$40.9*	*$349.9*	*$9.7*	*$26.4*
City and County of Honolulu Share	*$4.5*	*$38.9*	*$1.1*	*$2.9*
Income Taxes				
On- and Off-Site Workers	$25.3	$263.2	$2.0	$16.1
State of Hawai'i Total	$120.6	$855.1	$34.5	$65.5
City and County of Honolulu Total	$4.5	$38.9	$1.1	$2.9

All figures are Millions of 2011 $s	Cumulative Proposed Action	Full Build-out	Resort Residential	Conservation Partner
Through 2025				
Conveyance Taxes	$5.1	$2.4	$9.7	$1.9
Taxes on Visitor Accommodations				
Transient Accommodations Tax (Hotel Condominiums and Visitors in Resort Residential Units)	$32.9	$18.1	$23.2	$26.3
Transient Occupancy Tax (Time Shares)	$16.3	$3.7	$0.0	$6.6
Taxes on Cash Flows from Visitor Spending				
Excise Taxes				
On Lodging (Visitors only)	$16.0	$8.8	$11.3	$12.8
On Other Visitor Spending	$17.7	$11.6	$6.0	$21.5
On On- and Off-Site Workers' Spending	$11.7	$7.3	$1.6	$11.9
Excise Tax Total	$45.5	$27.7	$19.0	$46.2
State of Hawai'i Share	*$40.9*	*$25.0*	*$17.1*	*$41.6*
City and County of Honolulu Share	*$4.5*	*$2.8*	*$1.9*	*$4.6*
Income Taxes				
On- and Off-Site Workers	$25.3	$15.9	$3.5	$41.8
State of Hawai'i Total	$120.6	$65.0	$56.1	$164.6
City and County of Honolulu Total	$4.5	$2.8	$1.1	$7.5
Through Full Absorption *Year:*	***2025***	***2053***	***2025***	***2022***
Conveyance Taxes	$5.1	$7.1	$9.7	$1.9
Taxes on Visitor Accommodations				
Transient Accommodations Tax (Hotel Condominiums and Visitors in Resort Residential Units)	$32.9	$193.3	$13.2	$17.3
Transient Occupancy Tax (Time Shares)	$16.3	$41.6	$0.0	$3.9
Taxes on Cash Flows from Visitor Spending				
Excise Taxes				
On Lodging (Visitors only)	$16.0	$94.0	$6.4	$8.4
On Other Visitor Spending	$17.7	$173.0	$3.4	$13.5
On On- and Off-Site Workers' Spending	$11.7	$121.8	$0.9	$7.4
Excise Tax Total	$45.5	$388.8	$10.7	$29.3
State of Hawai'i Share	*$40.9*	*$349.9*	*$9.7*	*$26.4*
City and County of Honolulu Share	*$4.5*	*$38.9*	*$1.1*	*$2.9*
Income Taxes				
On- and Off-Site Workers	$25.3	$263.2	$2.0	$16.1
State of Hawai'i Total	$120.6	$855.1	$34.5	$65.5
City and County of Honolulu Total	$4.5	$38.9	$1.1	$2.9

NOTES: All taxes estimated from current rates (excise at 4.5%; TAT at 9.25%; TOT at 7.25% of half of maintenance fee for period of occupancy; conveyance taxes at escalating rates depending on cost and whether buyer is a Hawai'i resident) and historic ratios between earnings or revenues and taxes. Excise tax on workers' income estimated for taxable disposable income. Property sale values and maintenance fees estimated by Belt Collins Hawaii based on information from TBR and review of comparable projects. The values shown are rounded, so totals may differ slightly from the sum of the individual values in the table.

SOURCES: See Table 4-9.

Table 5-9: Increased Property Tax Revenues for the City and County of Honolulu, Proposed Action and Development Alternatives

All $ figures are Millions of 2011 $s	Cumulative Proposed Action	Full Build-out	Resort Residential	Conservation Partner
Through 2025				
Land Redeveloped (acres)				
Cumulative	221	74	217	123
Value of Redevelopment (Mill $s)				
Residential Construction	$441.0	$146.8	$304.1	$115.1
Residential Land	$586.8	$136.7	$918.7	$281.5
Hotel Construction	$175.9	207.2	$0.0	$162.8
Hotel/Resort Land	$202.7	$125.7	$0.0	$198.7
Total redevelopment counted	$1,406.4	$616.5	$1,222.7	$758.1
Cumulative Property Taxes				
Residential	$26.0	$7.6	$31.3	$12.7
Hotel, Resort	$24.3	$20.3	$0.0	$35.4
Total Collections	$50.3	$27.9	$31.3	$48.1
Through Full Absorption *Year:*	***2025***	***2053***	***2025***	***~~2023~~ 2022***
Land Redeveloped (acres)				
Cumulative	221	217	217	123
Value of Redevelopment (Mill $s)				
Residential Construction	$441.0	$291.5	$304.1	$115.1
Residential Land	$586.8	$291.0	$918.7	$281.5
Hotel Construction	$175.9	$863.3	$0.0	162.75
Hotel/Resort Land	$202.7	$547.5	$0.0	$198.7
Total redevelopment counted	$1,406.4	$1,993.3	$1,222.7	$758.1
Cumulative Property Taxes				
Residential	$26.0	$51.4	$31.3	$8.5
Hotel, Resort	$24.3	$359.9	$0.0	$22.0
Total Collections	$50.3	$411.3	$31.3	$30.5

NOTES: Land development totals take into account new hotel and residential parcels. Commercial development, changes from golf course use to open space, and increased commercial land values are not considered. The values shown are rounded, so totals may differ slightly from the sum of the individual values in the table.
SOURCES: See Table 4-10.

Table 5-10: Revenue-Cost Summary, Proposed Action and Development Alternatives, through 2025

All $ figures are Millions of 2011 $s	Proposed Action	Cumulative Full Build-out	Cumulative Resort Residential	Cumulative Conservation Partner
Through 2025				
State of Hawai 'i				
Revenues (Mill. $s)	$193.9	$108.3	$108.2	$137.2
Average cost, Visitors $2,171				
Cumulative Census, Visitor-years at Resort	12,729	13,517	3,989	6,664
Visitor-Related Costs (Mill. $s)	$27.6	$29.3	$8.7	$14.5
Average cost, Residents $6,830				
Full-time Resort Residents at Resort	416	557	372	210
Resident-Related Costs (Mill. $s)	$2.8	$3.8	$2.5	$1.4
Total Costs	$30.5	$33.1	$11.2	$15.9
Net Revenues > Costs	$163.4	$75.1	$97.0	$121.3
Revenue/Cost Ratio	6.4	3.3	9.7	8.6
City and County of Honolulu				
Revenues (Mill. $s)	$59.7	$33.5	$35.4	$37.4
Average cost, Visitors $1,060				
Cumulative Census, Visitor-years at Resort	12,729	13,517	9,352	6,664
Visitor-Related Costs (Mill. $s)	$13.5	$14.3	$9.9	$7.1
Average cost, Residents $1,485				
Full-time Resort Residents at Resort	416	557	372	210
Resident-Related Costs (Mill. $s)	$0.6	$0.8	$0.6	$0.3
Total Costs	$14.1	$15.2	$10.5	$7.4
Net Revenues > Costs	$45.6	$18.3	$24.9	$30.0
Revenue/Cost Ratio	4.2	2.2	3.4	5.1

All $ figures are Millions of 2011 $s	Cumulative			
	Proposed Action	Full Build-out	Resort Residential	Conservation Partner
Through 2025				
State of Hawai 'i				
Revenues (Mill. $s)	$193.9	$108.3	$108.2	$199.6
Average cost, Visitors $2,171				
Cumulative Census, Visitor-years at Resort	12,729	13,517	3,989	6,664
Visitor-Related Costs (Mill. $s)	$27.6	$29.3	$8.7	$14.5
Average cost, Residents $6,830				
Full-time Resort Residents at Resort	416	557	372	210
Resident-Related Costs (Mill. $s)	$2.8	$3.8	$2.5	$1.4
Total Costs	$30.5	$33.1	$11.2	$15.9
Net Revenues > Costs	$163.4	$75.1	$97.0	$183.7
Revenue/Cost Ratio	6.4	3.3	9.7	12.6
City and County of Honolulu				
Revenues (Mill. $s)	$59.7	$69.6	$35.4	$35.7
Average cost, Visitors $1,060				
Cumulative Census, Visitor-years at Resort	12,729	13,517	9,352	6,664
Visitor-Related Costs (Mill. $s)	$13.5	$14.3	$9.9	$7.1
Average cost, Residents $1,485				
Full-time Resort Residents at Resort	416	557	372	210
Resident-Related Costs (Mill. $s)	$0.6	$0.8	$0.6	$0.3
Total Costs	$14.1	$15.2	$10.5	$7.4
Net Revenues > Costs	$45.6	$54.4	$24.9	$28.3
Revenue/Cost Ratio	4.2	4.6	3.4	4.8

NOTE: See Tables 4-12 and 4-13 for average cost analyses. Revenue calculations bring together information from Tables 5-7 through 5-9. The values shown are rounded, so totals may differ slightly from the sum of the individual values in the table.

5.4 Social Impacts

5.4.1 Housing

Housing impacts differ among the alternatives because these involve fewer community housing units than the Proposed Action, and because the alternatives vary in the number of workers (and hence workers' households) they support in the region. Both the Proposed Action and the Resort Residential Alternative involve a larger increase in housing supply than in demand. The Full Build-Out Alternative might generate more demand than housing for residents (based on the high estimate in Table 5-11). The Conservation Partner Alternative would clearly involve more demand for resident housing than the supply of community housing provided.

When construction of the Full Build-Out Alternative is complete around 2053, demand for housing from operations-related workforce households is estimated as 234 to 469 additional units, resulting in a net excess of demand over the supply provided by the resort expansion of 144 to 379 housing units in the KNS region.

Table 5-11: Housing Impacts, Proposed Action and Development Alternatives

Based on development through 2025	*Action and Alternatives* Proposed Action	Full Build-out	Resort Residential	Conservation Partner
New Operations-Related Jobs				
On-site	753	530	48	469
Other direct jobs, KNS region (1)	177	109	14	161
	930	640	61	630
Dependents supported by new KNS workforce (2)	965	663	64	653
Households supported by workforce	556	382	37	377
New household formation over time (3)				
Low estimate (15%)	83	57	6	57
High estimate (30%)	167	115	11	113
New community housing at TBR	160	90	46	48
Housing Impact (Demand for Units):				
Low Estimate	77	33	40	(9)
High Estimate	(7)	(25)	35	(65)

NOTES: On-site jobs estimated in Table 4-3 and Table 5-3; off-site jobs derived from Table 4-4 and Table 5-4.

(1) Other direct jobs estimated as 40% of direct and indirect workforce supported by off-resort spending.

(2) Dependency ratios from 2006-2010 Five-year estimates for KNS region:

Population in households	31,111
Workforce	15,275
Average household size	3.41

(3) New housing demand estimated as 15% to 30% of workforce households.

SOURCE: American Community Survey. (www.census.gov)

5.4.2 Public Safety Services and Facilities

Following the ratios and projections used above, new public safety services demand associated with the Full Build-Out Alternative could come to about 4.8 police patrol positions and 3.3 fire control positions by 2025; the total public service demand would climb to 14.0 police positions and 9.6 fire positions at completion. The eventual new population with the Full Build-Out might well justify acquisition of new equipment such as an additional fire truck. It might justify construction of additional space for public safety operations, if perhaps not a new facility.

The Proposed Action and the other development alternatives could justify modest increases in public safety personnel and equipment, but not new facility construction. The Resort Residential Alternative could, based on current staffing ratios, justify 1.0 additional police patrol positions and 0.7 fire control positions. The Conservation Partner Alternative could justify an additional 3.6 police positions and 2.5 fire positions.

The cost of new fire control and police services has already been estimated through the average cost analysis (in Table 5-10).

As noted for the Proposed Action, redevelopment of the resort would bring increased patrols by resort security. New roadways, park facilities and landscaping would remove large areas of brush from the TBR lands. New construction would be to current fire codes, reducing the risk of fire and increasing access to the entire resort. All of these factors would tend to reduce the effects of development on public safety services.

5.4.3 Educational Facilities

The high estimate of potential new school enrollment associated with the other development alternatives is lower than with the Proposed Action, because the Proposed Action includes a larger commitment to Community Housing. Table 5-12 shows that the development alternatives would generate less demand for spaces in the public schools than the Proposed Action as of 2025.

For the Full Build-Out Alternative, construction and increases in operations jobs would continue until about 2053. By that time, total potential regional project-related new school enrollment would be in the range from 98 to 210 students. That range is much larger than those in Table 5-12. Based on the high estimate, project-related enrollments could reach up to 4.4% of the 2011 total regional DOE enrollment. If that enrollment increase occurred on a regional level within a year or two, the DOE might need to take steps to assure that all students can be housed and taught effectively. However, the increase projected here would occur over forty years. In that time, other changes in standards, practices, and demography would intervene, so it is simply not clear whether the eventual project-related growth with the Full Build-Out Alternative (i.e., the growth anticipated under existing permits) would present a small challenge to the regional DOE schools or a large one.

Table 5-12: Potential New Public School Enrollment, Proposed Action and Development Alternatives, to 2025

	Action and Alternatives			
	Proposed Action	**Full Build-out**	**Resort Residential**	**Conservation Partner**
New Community Housing	160	90	46	48
New Households Formed by Workers				
Low Estimate	83	57	6	57
High Estimate	167	115	11	113
Potential New K-12 Enrollment				
Low Estimate	49	32	7	27
High Estimate	123	77	21	61

NOTES: See Table 4-15 for multipliers used to estimate school impacts, and Table 5-11 for housing estimates. See text for discussion of potential enrollment after completion of the Full Build-Out Alternative.

Based on current enrollment levels, demand for new preschool places in the region would be modest by 2025. (See Table 5-13.) By full absorption of the Full Build-Out Alternative, regional demand could climb to about 16 to 34 places.

With more resort employment and renewed state support, enrollments could climb. As noted earlier, these calculations are based on current demand for preschools in the KNS region, and could underestimate demand in more prosperous conditions.

Table 5-13: Potential New Preschool Enrollment, Proposed Action and Development Alternatives, to 2025

	Action and Alternatives			
	Proposed Action	**Full Build-out**	**Resort Residential**	**Conservation Partner**
New Community Housing	160	90	46	48
New Households Formed by Workers				
Low Estimate	83	57	6	57
High Estimate	167	115	11	113
Potential New Preschool Enrollment				
Low Estimate	8	5	1	4
High Estimate	20	13	4	10

NOTES: See Table 4-16 for multipliers used to estimate preschool impacts, and Table 5-11 for housing estimates. See text for discussion of potential enrollment after completion of the Full Build-Out Alternative.

5.4.4 Health Care

The new population associated with the Full Build-Out Alternative by 2025 could create demand for as many as 8.3 acute care beds and 0.9 Emergency Medical staff positions. The demand for medical services and facilities would be smaller with the Resort Residential Alternative or the

Conservation Partner Alternative than with the Proposed Action. After construction of the Full Build-Out Alternative finishes by 2053, demand for health care services for the new population at the resort could climb to 24.2 beds and 2.7 Emergency Medical staff positions.

The eventual demand associated with the Full Build-Out would be large in a region with limited health care facilities. It could make expansion of local health care facilities necessary. However, that demand would be realized over a period of many decades, so the impact of that demand cannot be clearly assessed at this time.

5.4.5 Recreational Opportunities

Under the Full Build-Out Alternative, much the same recreation facilities would exist as with the Proposed Action. Resort visitor demand for golf tee times would be even greater. The potential effects on other courses noted for the Proposed Action would also arise, and would probably be even greater.

In order to reposition the resort as an exclusive, upscale site for the Resort Residential Alternative or the Conservation Partner Alternative, the golf course operator could limit rounds on one course or both, and could offer preferential access to residents of the new resort homes. Consequently, access by hotel guests, nearby residents and golf tours would be limited and could become more expensive.

Since the Conservation Partner Alternative reduces golf at Turtle Bay to the Palmer Course alone, golf access would be even more limited than under the other alternative scenarios.

The Full Build-Out and Resort Residential Alternatives both include a beach club on Kuilima Bay. This would provide a separate venue for resort residents to enjoy beach and ocean activities. With the beach club serving part-time residents, the higher onsite population of the Full Build-Out Alternative might not lead to resource conflicts among residents, resort residents and visitors.

The Conservation Partner Alternative could increase access to Kawela Bay and would likely increase public knowledge of the area, while minimizing adjacent development. The resort and the Partner agency would need to anticipate a major increase in usage of the bay and its park.

As with the Proposed Action, the new park development under the various Development Alternatives could help visitors to spread out along the North Shore. However, the Full Build-Out Alternative includes a much larger on-site visitor population. In this case the beneficial effect of park development for the region could be offset by increased visitor numbers.

Under the No Action alternative, the two golf courses would remain, so the supply of golf tee times would be greater than with the development alternatives. Beach access and facilities would remain as they are at present. However, Kawela Bay has become known as a "secluded" spot where marine life can be observed, so an increase in the number of visitors from off-site is likely.

5.4.6 Geographic Extent of Effects

On-Site and Near the Resort

The development alternatives would bring new visitors, residents and on-site employees to the resort. The increase would be small in the case of the Resort Residential Alternative, since both occupancy and on-site employment are low with resort residential development. Occupancy levels for hotels with the Full Build-Out Alternative are expected to be somewhat lower than for the other scenarios, but on-site population and employment would still be much higher in this case, due to the size of the Full Build-Out Alternative development. Also, construction workers would be on-site until 2052, under the Full Build-Out scenario, adding to the resort daytime population.

The Conservation Partner Alternative might bring a larger number of day visitors than the Proposed Action and the other alternatives. The unique qualities of Kawela Bay and the coastline could be emphasized by the partner (and likely advertised), and access to shoreline resources would be improved, while few on-site visitors using the resources would compete with day visitors.

For the existing properties, the development alternatives could have distinct effects:

- The Full Build-Out Alternative would involve a much larger resort expansion than the Proposed Action. In order to achieve acceptable levels of occupancy, operators may have to accept lower price points. The resort would then appeal to a larger, but less exclusive, market. The amenities proposed for this alternative would have higher usage with more visitors on-site. Hotel developers and operators might choose to position the hotels at Kawela Bay and towards Kahuku Point as more upscale than the central properties, just as end units in a townhome complex tend to have greater appeal than ones in the middle of a line of units. Consequently, the central area of the resort, including the Turtle Bay Hotel and Kuilima Estates, could benefit less from redevelopment than peripheral sites. Under these circumstances, the risk that redevelopment would emphasize the age and relatively modest architecture of the Kuilima Estates units would be greater than with the Proposed Action. (In this case, the Kuilima Estates owners might invest in improvements to common areas to enhance their properties, and thereby maintain value.)

- With the Resort Residential Alternative, the resort's reputation would rest above all on new, luxurious homes near the ocean and the Palmer course. The existing Kuilima Estates condominiums would be more likely to be seen as no longer in keeping with the rest of the resort, and could suffer from the contrast. (As noted above, the condominium owners could invest to maintain their property values.) Also, improvements in the resort's landscaping and beach access could make these properties more appealing.

  As the only hotel, the Turtle Bay Hotel can be expected to continue to support high occupancies. This alternative would increase demand for existing restaurants and other amenities slightly, but the on-site population increase would be small.

- The Conservation Partner Alternative's effect on existing properties would be much like that of the Proposed Action. However, the Fazio course could be entirely closed, and the open space between the condominiums and the newly developed areas would narrow slightly. Whether these changes would affect the appeal and value of the condominiums would depend on design choices that have not been spelled out yet. Much as with the Resort Residential Alternative, the success of this alternative would depend on positioning new residential properties as luxurious and ocean-oriented. Again, the existing condominiums could suffer from the contrast.

While the Kuilima Estates condominiums might not enjoy increased value and reputation from resort development under the Resort Residential and Conservation Partner Alternatives, they would not lose or gain value simply by being near more expensive homes. No clear impact on their property values appears likely.

The No Action alternative could lead to effects on Kawela Bay. Continuing growth in the number of visitors is likely. Under the No Action alternative, no new measures would be taken to monitor human activity in the bay or control shoreline littering.

Regional Effects

Both the Full Build-Out Alternative and the Conservation Partner Alternative would support many new jobs in the region (approximately 640 and 627 jobs respectively by 2025). New job creation would continue under the Full Build-Out Alternative, reaching a total of about 2,613 regional jobs by 2053. While new job creation demand could be met locally over time, the resort's share of local employment would rise, reaching perhaps 25% of jobs in the region. As noted in the preceding sections, this alternative could eventually increase demand for schools, public safety and health services to a point that additional facilities might be needed. If the State and the City and County responded in a timely manner, the result could involve minimal effects for the region.

In contrast, the Resort Residential Alternative is expected to generate very few off-site jobs through visitor expenditures in the region. It would do little to lower unemployment and would offer few employment choices to local youth.

Table 5-6 shows the estimated new regional populations associated with the Proposed Action and the Development Alternatives.

The No Action alternative is not expected to affect regional populations and communities.

Island and State Effects of the Development Alternatives

All the development alternatives would generate revenues for local government The Full Build-Out Alternative could eventually lead to demand for new public facilities in the region, i.e., to government costs beyond the average-cost figures discussed earlier. However, by the time the effects of this large alternative were felt, increased revenues associated with the resort would be

very large, as estimated in Table 5-10 -- and likely would be more than enough to cover the additional costs of facility expansion, given prudent planning by government agencies.

5.4.7 Quality of Life and Community Cohesion

The three development alternatives could have somewhat different effects on the surrounding communities:

- **Full Build-Out Alternative**: The longer development period and larger visitor population anticipated with the Full Build-Out would have distinctive effects. If major construction stretches over decades, local contractors and construction workers could find nearly continuous work close to home. However, the larger visitor population would mean that some resort and natural resources – golf tee times and enjoyment of offshore waters – would be much less available to local residents over time. The larger visitor population would patronize local shops and restaurants and could contribute to congestion along the streets and shores of the region.

- **Resort Residential Alternative:** In this scenario, the new visitor population would be fairly small and affluent. Resource competition is less of an issue, unless new homeowners attempt to limit local residents' access to beach and marine resources. (BCH expects that the UA, policies of the TBR developer, and community vigilance would guarantee residents' access.) Much as with the Proposed Action, some resort residents could become active members of the regional community.

- **Conservation Partner Alternative:** This scenario depends on an unknown factor, a conservation partner willing and able to invest in the land in order to limit development to the center of the SEIS lands. That partner could affect access to and use of ocean and park resources in ways that cannot be foreseen. The partner could welcome residents, resort residents, and visitors or it could seek to keep the Kawela and Kahuku Point areas little disturbed. To date, no such partner has emerged, despite the urgings of the State government and local stakeholders.

The new visitors and employees brought by the development alternatives will contribute to regional traffic. See the Traffic Impact Assessment Report in the SEIS for further detail on the project's contribution to regional congestion and on traffic management strategies.

5.4.8 Secondary and Cumulative Impacts

When the effects of the development alternatives on regional population, housing and public services are seen in combination with potential effects of the Envision Lāʻie initiative, need for new public facilities appears much more likely. That project could have a large effect on the local resident population, justifying school expansion, before development at Turtle Bay would do so. If the Full Build-Out Alternative and all the housing proposed for Malaekahana were developed, regional demand for school, health, and public safety facilities would increase significantly. On the other hand, if the resort, BYUH and PCC provided new jobs, while the

Malaekahana and Turtle Bay community residential areas housed the workers for all three job centers, the combined impact could be limited.

5.5 Comparisons of Likely Socio-Economic Effects of the Proposed Action and Alternatives

5.5.1 Comparison with the Impacts Discussed in the 1985 Kuilima Revised Final EIS

The development proposed in the Kuilima EIS and accepted when permits were issued was substantially larger than the Proposed Action. The Kuilima EIS dealt with a different social context than the current SEIS does. Resort development has also changed in emphasis and risk management. In this section, major changes are noted as broad trends.

Resort Development

In 1985, hotels and condominiums were viewed as separate facilities. In the current marketplace, resorts tend to offer visitors a range of ownership and rental options, from condominium ownership through fractional ownership to rental of overnight accommodations, and may do so in the same structure. Design of hotels as condominium or time-share properties reduces risk for the developer, since the sale of units or time shares can defray costs quickly, and for the operator, since owners of time shares and condos have a vested interest in using their units. Long-term occupancy is typically more secure than it is for stand-alone hotels. Contemporary hotel properties involve a mix of occupancy types, and are likely to have higher occupancy levels than stand-alone hotels.

In 1985, most hotel rooms were bedrooms with attached bathrooms and lanais, with a low percentage of larger suites. Nowadays, studio, one and two-bedroom units with kitchen facilities are common. Often the larger units can be occupied either as a single unit or as two separate rentals (two "keys").

The Kuilima EIS identified a complex mix of positive and adverse socio-economic impacts. The themes noted above help to specify how the effects of the Proposed Action and alternatives differ from the major socio-economic impacts noted in 1985. Table 5-14 compares indicators of the impacts of each scenario. It shows both continuity and change.

Table 5-14: Comparison of Development Impacts, Kuilima EIS, Proposed Action and Alternatives

			Action and Alternatives -- in Comparison to the With-Project Future in the Kuilima EIS					
		Kuilima EIS and UA	**Proposed Action**	**Full Build-Out *(2025)***	**Full Build-Out *(2053)***	**Resort Residential**	**Conservation Partner**	**No Action**
New Resort Units	Units	3,410	1,215	1,060	3,410	454	692	-
	Keys (1)	Not listed	up to 1,590	NA	NA	NA	NA	-
Workforce / Community Residential Units		90 (2)	160	90	90	46	48	-
Employment	On-site Jobs	2,614	753	530	2,240	48	469	-
Change in the Regional Economy		Development of a tourism "base"	Increase in visitor economy	Increase in visitor economy	Major increase in visitor economy	Increase in visitor economy	Increase in visitor economy	-
Housing "pressures"		Regional problem exists, increased demand with project	Regional problem continues; project housing impact is likely positive	Regional problem continues; project housing impact is negative	Regional problem continues; project housing impact is negative	Regional problem continues; project housing impact is positive	Regional problem continues; project housing impact is negative	Regional problem continues
Increased Presence of Visitors	Visitors	4,783	2,206	2,202	5,968	483	1,477	-
Displacement of Residents	Persons	140	None	None	None	None	None	None
Displacement of Activities	Activities	UA commits resort to work for a Kawela Bay Marine Conservation Area	Resort would follow UA	Resort would follow UA	Resort would follow UA	Resort would follow UA	Resort would follow UA	None
New Recreational Opportunities		Parks, shoreline access	Parks, shoreline access	Parks, shoreline access	Parks, shoreline access (with many more visitors)	Parks, shoreline access	Parks, shoreline access	None

NOTES: NA = Not Available

(1) When a two- or three-bedroom unit isdesigned so its components can be rented separately, the various components are counted as "keys." Units that cannot be subdivided in this way are counted as single "keys." For this table, resort residential units are also counted as single "keys." TBR has committed to have no more than 1,000 keys for 625 hotel units in the Proposed Action. No similar analysis of hotel room counts has been made for Development Alternatives.

(2) The UA specifies that (a) at least 51% of resort units must be "full-service hotel" units and that (b) workforce housing must be developed, on-site or off-site. The number of workforce housing units must equal 10% of the resort non-hotel units. Workforce housing must be provided at rates affordable by families earning 80% of the County average median household income, under a program supervised by the City and County (now by DPP). The community housing proposed by TBR would at least meet, and probably go farther than, County rules to assure housing is available for local families.

On the one hand, the economic impact of changing the region's economy to a tourism base occurred long ago. On the other hand, housing remains tight and costly in the region. The Proposed Action and the Resort Residential Alternative would provide more new community housing units than resort-related workforce demand; the Full Build-Out Alternative and Community Partner Alternative would generate more demand than new community units.

Apart from the Full Build-Out Alternative, the Proposed Action and Development Alternatives would have smaller socio-economic impacts than those identified in the Kuilima EIS. The current Proposed Action and Development Alternatives no longer create the most obvious adverse impacts (dislocation, possible social consequences of economic transformation) because those impacts occurred some two decades ago.

Critics of the resort expansion have argued that the North Shore's appeal as a visitor destination has already brought far more visitors than were present in the 1980s, so any further resort growth would bring too many visitors. In part, this argument deals with traffic congestion. The traffic study for the SEIS speaks to this concern, separating the future effects of Turtle Bay Resort visitors from other island visitors and residents. In part, it deals with the prosperity and wellbeing of the region and its institutions. This criticism is overstated for several reasons:

- Many in the region view resort employment as valuable, and would welcome additional resort jobs for their children;

- Unemployment is slightly higher in the region than island-wide, and long-distance commuting is more common, so new jobs can help to address current traffic, commuting and quality of life problems;

- The Polynesian Cultural Center is planning to expand, and would presumably welcome more visitors in the region. Waimea Falls Park has barely survived as a viable destination with support from the Office of Hawai'ian Affairs. Once again, a larger regional visitor count could have welcome results for businesses in the area.

- Resort residents and visitors may well have different consumption patterns from day visitors staying in Waikīkī. Resort resident may be willing to spend more on clothes, furnishings, food and entertainment in the region than day visitors. Resort visitors may complement day visitors as customers for local retail outlets.

- Most significantly, recent Hawaii Tourism Authority surveys indicate that close to 75% of all Oahu visitors visit the North Shore independent of activities or development at Turtle Bay Resort. The addition of new resort amenities, legal transient accomodations and new transportation management operations could take traffic off Kamehameha Highway that would otherwise travel to and from and around the North Shore.

Of the various development alternatives, the Full Build-Out comes closest to bringing the future situation painted by the critics, since it would involve, as it builds out, many more visitors than the other alternatives, and a larger concentration of hotels. The Proposed Action and other alternatives combine smaller visitor populations with the development of beach parks. Hence

they would involve far less risk that visitors' presence would adversely affect the region's towns and shores.

5.5.2 Comparison with Regional Trends

Many stakeholders hope that the resort expansion will bring sustained prosperity to the KNS region but not erode the region's "country" atmosphere and public services. The Proposed Action supports those objectives.[48] Quantifiable socio-economic findings for the Proposed Action and alternatives are summarized in Table 5-15 in relation to the current situation or forecast regional trends.

Table 5-15 shows that, by 2025, the Proposed Action creates more jobs and housing than the other development alternatives. It would bring a resident population increase within the forecast growth for the KNS region. After 2025, the Full Build-out Alternative would bring more residents, visitors, jobs and housing demand. The public service demand associated with that alternative would come to be much greater than for the Proposed Action and other development alternatives, and could lead to need for new medical or public safety facilities.

[48] For estimates of the impacts of the resort expansion on regional traffic, see the SEIS appendix on traffic impacts.

Table 5-15: Development Impacts in Regional Context

		Proposed Action, 2025	Full Build-Out, 2025	Full Build- Out, 2053	Resort Residential, 2025	Conservation Partner, 2025	No Action
Employment							
Regional Jobs, 2009	6,203						
New Continuing Jobs at Resort		753	530	2,240	48	469	-
New Continuing Jobs in KNS Region		177	109	373	14	161	-
Total New Continuing Jobs		930	640	2,613	61	630	-
As share of 2009 regional jobs		**15%**	**10%**	**42%**	**1%**	**10%**	**0%**
As share of forecast regional job growth, 2010 to 2025	1,086	**86%**	**59%**	**NR**	**6%**	**58%**	**0%**
Wages (Million $s)							
Regional Wages, 2009	$116.3						
New Continuing Wages at Resort		$23.8	$16.8	$71.1	$1.6	$14.8	$0.0
New Continuing Wages in KNS Region		$7.4	$4.5	$15.5	$0.6	$6.7	$0.0
Total New Continuing Wages		$31.1	$21.4	$86.6	$2.2	$21.5	$0.0
As share of 2009 regional wages		**27%**	**18%**	**74%**	**2%**	**18%**	**0%**
Population							
Forecast Regional Population, 2025	34,969						
Forecast Resident Population increase, to 2025	1,576						
New Regional Residents due to Action or Alternative		951	877	3,000	152	824	-
As share of KNS Population, 2025		**3%**	**3%**	**9%**	**0%**	**2%**	**0%**
As share of forecast growth		**60%**	**56%**	**NR**	**10%**	**52%**	**0%**
Housing							
2010 Household size (popul. in hholds)	3.27						
Forecast Resident Population increase, to 2025	1,576						
New Households in Region (Forecast Regional Population Increase divided by 2010 Household Size	482						
Community Housing at Resort		160	90	90	46	48	0
As share of forecast household growth		**33%**	**19%**	**NR**	**10%**	**10%**	**0%**
Net Project-Related Regional Housing Supply							
Low Estimate		77	33	(144)	40	(9)	0
High Estimate		(7)	(25)	(379)	35	(65)	0
As share of forecast household growth							
Low Estimate		**16%**	**7%**	**NR**	**8%**	**-2%**	**0%**
High Estimate		**-1%**	**-5%**	**NR**	**7%**	**-13%**	**0%**

Continued on next page

Table 5-15 Cont.

		Proposed Action, 2025	Full Build-Out, 2025	Full Build- Out, 2053	Resort Residential, 2025	Conservation Partner, 2025	No Action
Public Schools							
2011 KNS region enrollment	4,826						
New Project-Related Enrollment, 2025							
Low Estimate		49	32	98	7	27	-
High Estimate		123	77	210	21	61	-
As share of 2011 Enrollment							
Low Estimate		**1%**	**1%**	**2%**	**0%**	**1%**	**0%**
High Estimate		**3%**	**2%**	**4%**	**0%**	**1%**	**0%**
Other Public Services							
Police: current number of officers/1,000 persons	1.56						
Fire: current number of officers/1,000 persons	1.07						
Emergency Medical Service: per 1,000	0.30						
Hospital Beds per 1,000 persons	2.70						
		2025	***2025***	***2053***	***2025***	***2025***	***2025***
New regional demand associated with Project							
(New residents and visitors)		3,157	3,079	8,968	635	2,301	-
Police		4.9	4.8	14.0	1.0	3.6	-
Fire		3.4	3.3	9.6	0.7	2.5	-
Emergency Medical Services		0.9	0.9	2.7	0.2	0.7	-
Hospital Beds		8.5	8.3	24.2	1.7	6.2	-

NOTES: See Tables 5-3, 5-4, 5-6, 5-11, 5-12, and Chapter 3 text on Public Services, for regional conditions and trends. Ratios comparing the 2053 absorption of the Full Build-Out Alternative to forecast 2025 trends are all marked NR, i.e., Not Relevant, since these impacts refer to a much longer time period. The values shown are rounded, so totals may differ slightly from the sum of the individual values in the table.

6 Summary of Benefits and Costs of the Proposed Action

The analysis in the last two chapters has covered a wide range of issues. This chapter reviews the beneficial and adverse effects of the Proposed Action under two main headings: regional social effects and fiscal effects.

6.1 Regional Social Life

The Ko‘olau Loa-North Shore region is famed for “country” atmosphere along with its beaches and surf spots. The Turtle Bay Resort currently fits into that atmosphere in many ways; its beaches and waters are enjoyed by residents as well as visitors. It provides amenities enjoyed by regional residents. It provides jobs on-site. With wages and benefits protected by union contracts, the resort establishes a high standard for local employment practices. Its guests contribute to visitor spending for goods and services throughout the region.

The analysis in earlier chapters has identified several effects of the Proposed Action that would generally be considered beneficial:

- **Job-creation**:
  - Some 3,263 person-years of direct construction employment over 11 years (plus indirect and induced jobs throughout the island), with a total direct payroll exceeding $225 million;
  - An operations workforce estimated as including 753 direct jobs at the resort, with an annual payroll of about $23.8 million (plus indirect and induced jobs), continuing for many years; and
  - Approximately 177 new jobs within the region supported by visitor spending outside the resort, including retail, service and other jobs.

- **Development of new amenities** which could be used by residents and tend to increase visitors’ time at the resort (vs. on the North Shore roadways):
  - New beach parks with parking and shoreline access, greatly improving access to both open coastline and an enclosed bay;
  - An inland park area next to the wildlife preserve;
  - A Gathering Place combining performance space, stores and other uses;
  - An on-site Farmers’ Market;
  - A new golf clubhouse and a new equestrian center;
  - Landscaping and new development set back from the beachfront; roads and trails throughout the resort’s grounds; and
  - Road improvements including two new entries that will take vehicles off Kamehameha Highway earlier.

- **New housing for community residents,** responding to a long-recognized regional need.

- **Attraction of upscale visitors** who value the North Shore as a place to stay, not just to visit for a few hours.

- **Attraction of resort residents and homeowners, a few of whom would likely contribute their support to community causes.** (Elsewhere in Hawai‘i, such contributions can range for funds for local hospitals to fervent support of environmental groups.)

All of these can contribute to a prosperous regional community. With shorter commutes, more residents have time to spend with family and neighbors, and to participate in community life.

Drawbacks of new development may include increased traffic and more visitors in regional communities. The traffic impact assessment for the SEIS estimates both existing traffic congestion and the impact of new resort development. It identifies traffic management strategies to reduce the project's contribution to this regional problem.

6.2 Fiscal Effects

Revenues for both the state and county would significantly exceed project-related costs with the Proposed Action. Table 6-1 shows the net revenues associated with the Proposed Action.

State revenues would continue to exceed costs by more than $14 million annually in later years. Net project-related revenues for the City and County would continue at a level over $6 million annually from 2025 onward.

Table 6-1: Revenue-Cost Summary, Proposed Action

	Cumulative, through 2025 *Million $ (2011)*
State Revenues	
Excise Tax	$84.1
Income Tax	$55.5
Transient Accommodations Tax	$32.9
Transient Occupancy Tax	$16.3
Conveyance Tax	$5.1
	$193.9
Costs for State	
For Visitors	$27.6
For New Residents	$2.8
	$30.5
Net Benefit (Revenues > Costs)	$163.4
Ratio of Benefits to Costs	6.4
City and County Revenues	
Excise Tax	$9.3
Real Property Tax	$50.3
	$59.7
Costs for City and County	
For Visitors	$13.5
For New Residents	$0.6
	$14.1
Net Benefit (Revenues > Costs)	$45.6
Ratio of Benefits to Costs	4.2

SOURCES: Tables 4-9 to 4-13.

As noted earlier, a new development can stimulate new spending by government agencies on public facilities. The new demand associated with the Proposed Action is not large enough to make such spending necessary, so the average cost approach provides a realistic estimate of the actual costs to government associated with the action.

7 Mitigations

7.1 Mitigations Proposed in Kuilima EIS and UA

Several conditions proposed in the Kuilima UA address socio-economic impacts.[49] These are summarized here, and the ways in which the Proposed Action addresses those conditions are discussed. The owners of the TBR accept the UA as running with the land, and hence would implement these conditions unless the UA is amended by City ordinance.

- UA Condition 3: Development shall "generally be based on" the schedule provided by the developer, although changed economic conditions or other circumstances could affect timing.

  Comment: The original schedule involved a timetable that ended before the present. The Proposed Action provides a new timetable responsive to current and anticipated market conditions. The actual timing of development could change, in response to changing economic conditions.

- UA Condition 3: A minimum of 51% of the 4,000 resort units (including the existing Turtle Bay hotel) shall be operated as full service hotel units.

  Comment: When "units" are counted, 65% of resort units in the Proposed Action (counting the Turtle Bay Hotel) are in hotels. When possible "keys" are counted, the share is 71%. No general definition of "full service hotel units" exists. However, DPP accepts traditional hotels, condominium hotels and time share properties as covered by this term.

  In the Kuilima EIS, hotels are discussed as employing far more workers than condominiums, so the designation of hotels in the Proposed Action as condominium or time share properties raises the question of whether this condition is still being met. It is the overall level of service provided, along with on-site resort amenities, that separate visitor properties with more or less operational employment, not the arrangements for leasing units. The operations employment figures estimated in this report are somewhat lower than those found in the Kuilima EIS. Largely that is because of productivity gains throughout the Hawai‘i hotel industry in recent decades. On-site employment is expected to be comparable to that in other resorts in Hawai‘i (and higher than that found in many hotels).

[49] The UA also includes conditions dealing with setbacks, other design conditions, roadways and historic/cultural sites, not discussed in this list. Comments in this section express the findings and views of BCH. They may report on commitments of the developer, but they do not constitute such commitments.

- UA Condition 4: Workforce housing shall be provided for sale to residents of the region; the number of workforce housing units shall equal 10% percent of the non-hotel dwelling units in Turtle Bay Resort (not including Kuilima Estates) .

  Comment: The Proposed Action exceeds this requirement by 171% with 160 vs. 59 units (i.e., 10% of 590 resort residential units), both by providing more units and by providing them at prices based on cost and local budgets, not County-wide income levels.

- UA Condition 5: To offset potential loss of access with development, the developer committed to developing parks once the resort expansion was under way. Parks would be dedicated to the City and County; parking and shoreline access would be provided.

  Comment: The Proposed Action and Development Alternatives continue to include these parks, and in the case of the Proposed Action, exceed them by 27.3% providing additional park space and public shoreline accesses for a total of 69.5 acres, 14.9 acres in addition to those required.

  (Some residents who live nearby have expressed a wish that the resort, not the City and County, would be responsible for the parks' maintenance and security. TBR is committed to meeting the terms of the UA. It would be in the interest of hotel operators and resort residents to support the City and County Parks Department in maintaining these parks.)

- UA Condition 7: All major roadways shall be open to the public. The developer shall minimize vehicle usage by means of:
  - Shuttle services to the airport, Waikīkī and PCC; and
  - Employee transportation services for points from Haleʻiwa to Kaʻaʻawa to the resort, provided at a reasonable cost.

  Comment: These transportation services will need to be developed based on the traffic studies for the Proposed Action and consultation with employees.

- UA Condition 11: Developer shall establish a child-care center for employees of the resort; a half acre of land shall be dedicated (in or near the resort) to North Shore Career Training for this purpose.

  Comment: Since the time of the Kuilima EIS, child-care facilities in the region have increased. Meanwhile, the regional population is aging, so the number of current and new resort employees who need child-care may have decreased. Extensive studies were made of the need of employees and others for services (e.g., day care for infants and for toddlers, preschool education, after school care, sick child care, or evening care to help parents on evening shifts).[50] These would need to be updated. North Shore Career Training's operational core, Resort Training Inc., is still in operation.

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[50] These studies were conducted for the Kuilima/North Shore Strategy Planning Committee with the support of the Turtle Bay developer. That group has resumed meetings in recent years.

- UA Condition 12: Developer shall establish an employment training program and provide at least $500,000 for this purpose. (The amount cited will be provided in four years from the time that zoning is granted.)

  Comment: The payments identified under this condition were made by the developer to Resort Training Inc. soon after the UA was issued.[51] Since that time, Resort Training Inc. has continued operations. It is currently housed at the Turtle Bay Resort on a complimentary basis. Like other social service providers, it has been affected by budget cuts in recent years, but it is involved in training contracts with local employers. With resort expansion, the operators of new hotels will likely sponsor additional training.

- UA Condition 13: Developer shall work with the Kuilima/North Shore Strategy Planning Committee (KNSSPC) throughout the development of the resort.

  Comment: TBR is working with advisory groups, including KNSSPC, in order to design programs that address regional residents' needs and concerns; TBR has organized over 170 meetings, workshops and open houses with community groups and concerned citizens since 2010.

- UA Condition 14: Developer shall use its best efforts to promote the creation of a Marine Life Conservation District at Kawela Bay.

  Comment: TBR will work to meet this condition. Because it is not clear if such a district would affect local ocean recreation and fishing activities, TBR is recommending the creation of a regional Advisory Council to help determine the best course of action to address this requirement. The developer would seek to explore ways to establish a conservation regime at Kawela Bay in dialogue with others who have a stake in the use and preservation of the bay and its shores.

7.2 Mitigation for Possible New or Intensified Impacts of the Proposed Action

Mitigation measures for socio-economic impacts involve two distinct types of solution. To the extent that the problem is a technical one, and experts are recognized as the source of technical solutions, mitigation measures may consist of technical solutions applied when expert models find appropriate. Many traffic impacts are of this type, since transportation agencies and experts work out solutions based on their experience in dealing with congestion, and the agencies have extensive power to mandate which measures count as appropriate mitigation measures.

More often, socio-economic impacts combine material impacts, perceptions, and interactions. Addressing those impacts demands not just technical solutions but a process of identifying how problems and solutions are perceived, what stakeholders see as an appropriate response, and who can or should participate in mitigating the impact. Effective mitigation measures involve consultation and shared assessment of what works.

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[51] Personal communication, Robert Comeau, Executive Director, Resort Training Inc. May 2012.

The vision of the future enunciated in the SEIS combines a holistic view of the land and people, stewardship, and a commitment to consultation with elders, neighbors, and other stakeholders. It identifies relationships and discussions that seem well suited to mitigation as an ongoing process of sustaining the land and people of the area. In other words, the SEIS identifies a promising framework for effective mitigation. Within that framework, three issues stand out as productive ones for further work to craft responses that suit the needs of local stakeholders.

1. **Parks and Sustaining Shorelines and Near-shore Resources.** The Proposed Action would increase the number of visitors in the region, and especially along the shores from Kawela Bay to Kahuku Point. The UA directs the developer to deal with this impact through park dedication. Since City and County park budgets are limited, this action may have the unintended consequence of deeding shore lands to the party least able to patrol, maintain and sustain them as a valued resource. The resort operator, homeowners and residents would likely be interested in assuring peace, quiet and clean enjoyment of the parks. (So, presumably, would their neighbors along the western shore of Kawela Bay.) They would need to establish working agreements with each other and the City and County Department of Parks and Recreation to share both enjoyment of and responsibility for the park areas.

2. **Child Care.** The UA directs the establishment of a child care center. What sort of center is needed, what age children need to be served, and how the center can collaborate with existing preschools and programs in the region remain to be seen. (These questions were examined in discussions with the Kuilima North Shore Strategy Planning group and research done for that group by Community Resources, Inc., but the research is now dated.) The developer, employees who may need support from a child-care center, and local providers can all contribute to developing an effective mitigation strategy, not just fulfilling a legal condition.

3. **Employee and Visitor Shuttle Operations.** The specifics of these operations will be developed based on studies of the traffic situation and input from employees.

7.3 Mitigation for Possible Socio-Economic Impacts of the Alternatives

Because the UA follows the land, it is binding for all development alternatives. The timing of actions such as parks development would need to be revised in the case of the Resort Residential Alternative, since hotel development triggers some UA conditions, and the Resort Residential Alternative involves no new hotels. The developer would comply with all applicable requirements.

The comments in the last section on mitigation measures and process hold true for all the alternatives, although each presents distinct challenges and opportunities. The Full Build-Out Alternative most closely resembles the development plans in the Kuilima EIS, so the Kuilima UA mitigations align well with it. The Proposed Action and other Development Alternatives involve much less new development, and hence may need somewhat different approaches to mitigation.

Full Build-Out Alternative

The Full Build-Out Alternative would involve many more visitors at the resort, and larger and taller structures set closer to the shoreline than with the Proposed Action. Hence potential competition for shore and ocean resources would be greater. It may be appropriate for the resort to take the lead in maintenance of the shoreline and protection of near-shore waters – but questions would likely emerge as to whether the resort is turning a public resource into a private one. Continuing consultation and shared responsibility with other stakeholders would be important.

As noted above, the Full Build-Out Alternative involves greater resident housing demand and a smaller community housing contribution than the Proposed Action, so housing impacts would be greater with this alternative.

Resort Residential Alternative

The Resort Residential Alternative involves smaller impacts based on the numbers of visitors and jobs. Its impacts would instead have more to do with differences between new homeowners, on the one hand, and existing nearby residents (in Kuilima Estates and West Kawela), the hotel, and beachgoers. New owners in the high-end residential development may seek to keep their spaces as exclusive as possible similar to existing Kawela homeowners. Since their homes would be nearer the parks than the hotel is, community associations may take a major role in park management and security. The UA is clear on the need to maintain public access on all major roadways and shoreline access routes. However, homeowners would want assurance that their own property is secure, so the possibility of conflict involving community associations and their security personnel may be an issue. Involvement of the residential community associations in a wider resort operating group may be necessary to minimize or avoid such conflict. TBR expects to form a master resort association in the course of development under this or other alternatives.

Conservation Partner Alternative

The Conservation Partner Alternative would involve social differences and exclusionary tendencies similar to those described for the Resort Residential Alternative. Mitigation measures in this case would depend greatly on the policies and involvement of an unknown party, the Conservation Partner. If that partner emphasizes resource preservation, it may constrain public beachgoers and recreation activities (including surf schools) while assuring nearby residents of peace and quiet. If that partner emphasizes public access to and regulation over shared resources, the result could be a significant increase in the number of visitors at the shoreline parks, and development of new educational programs rather than recreational businesses. A resort operating group or association would no longer be the venue for collaboration among stakeholders. Instead, the agreement between the partner and the resort would set the terms for future decision-making.

No Action Alternative

Compared to the future allowed by existing permits, the No Action Alternative involves few impacts and none of the mitigations specified in the UA. Access to shoreline resources would continue to be limited.

Over the long term, resources such as the Fazio course and shore areas could be degraded by erosion or use without sufficient funding to maintain them. Visitors to Kawela Bay from outside the resort would probably increase in number, affecting the shoreline and bay. Under the No Action Alternative, the resort, its residents and homeowners might not be able to invest in sustaining and redeveloping ~~them~~ these resources.. Hence, while continuing operation of the resort is anticipated, its long-term viability and environmental sustainability could be less certain than with the Proposed Action.

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Appendix A: Regional Geography

Table A-1: Communities, Districts and Places in the KNS Region

Communities in the Koʻolauloa/North Shore Region, from West to East

	Mokulēʻia	Waialua	Haleʻiwa	Kawailoa	Waimea Bay	Pupukea-Sunset Beach	Kawela	Kuilima	Kahuku	Lāʻie	Hauʻula	Punaluʻu	Kahana	Kaʻaʻawa
U.S. Census														
1980	99.01		99.02	100	101					102.02	102.01			
1990	99.01		99.02	100	101					102.02	102.01			
2000	99.01		99.02	100	101					102.02	102.01			
2010	99.04		99.02	100	101					102.02	102.01			
2010 names	Kaena Point		Haleiwa	Kawailoa	Waimea-Kahuku					Laie	Hauula - Kaaawa			
CDPs	Mokuleia	Waialua	Haleiwa		Pupukea		Kawela		Kahuku //	Laie //	Hauulu	Punaluu		Kaaawa
State of Hawaii														
	Waialua (North Shore) District				Koʻolauloa District									
City and County of Honolulu														
	North Shore SCP						Koʻolau Loa SCP							
	North Shore Neighborhood Board, No. 27						Koʻolauloa Neighborhood Board, No. 28							

NOTES: "CDP" = Census Designated Place(s). Parts of the region are not included in any CDP. This is indicated above in two ways. First, some communities are simply not included in CDPs, and are outside the named boxes. Second, CDP boundaries may not be contiguous. In the table. "//" indicates where CDP boundaries of nearby named communities are not contiguous.
CDP boundaries may have changed slightly over time, due to changes in mapping procedures.
The Waialua District is often termed the North Shore District. Other names reflect spelling conventions used by the agencies named in the table.
The State judicial districts are also designated Census Divisions.
2010 Census Tract names are supplied by State Data Center, DBEDT.

Appendix B: Economic, Demographic and Fiscal Notes

B.1 Approach

The quantitative analysis is intended to provide realistic estimates of major socio-economic effects of development at Turtle Bay Resort as compared to the No Action Alternative. It depends on models that have been developed and refined to account for the Hawai‘i economy. It incorporates assumptions about the visitor industry that have been chosen as mid-range or conservative.

Development of the resort as proposed by TBR would occur over many years; development according to alternative scenarios would take more time, in the case of the Full Build-Out Alternative, or less time, for the Conservation Partner Alternatives.

For this analysis, resort development is understood above all as attracting capital from outside the Hawai‘i regional economy. That capital comes first in the form of funds for construction and later as visitors' expenditures in the course of their vacation experience.

B.1.1 Sources and Assumptions

The quantitative analysis begins with information and assumptions about:

- What will be built (supplied by TBR);
- When will it be built (by TBR);
- What will construction cost (by BCH, based on input from TBR and current cost data from other sources);
- What market will be served, and hence what are likely timeshare, condo and housing prices (by BCH, based on input from TBR, comparative data from other resorts, and analysis of data on resort unit sales and North Shore residential sales); and
- Activities and employment on-site (supplied by TBR and operators).

The account of effects on the Hawai‘i economy relies on sources and models that have been refined over many years in light of both local and global trends:

- The Hawai‘i Input-Output Model, providing estimates of the regional impact of the introduction of new capital to Hawai‘i. This has been developed and refined over decades. The current version incorporates 2007 economic census data as well as DBEDT findings and analysis. The key multipliers used from this model are for indirect and induced jobs associated with growth of jobs in various industries. The Type II multipliers

(i.e., the number of direct, indirect and induced jobs associated with each direct job) used are:

- Construction 2.68
- Retail 1.54
- Real Estate/leasing 2.68
- Accommodations 2.23
- Food service 1.55
- Other services 1.63

All Input-Output analyses deal with the circulation of capital in a regional economy. They may be expressed in terms of jobs, personal income and/or output. However, these are alternative measures of the same economic activity, not separate impacts. Consequently, the current analysis is rooted in estimates of job creation, for which wages can be forecast based on recent wages.

- Hawai‘i Long-Range Population and Economic Projections, also maintained by DBEDT and based on econometric models, providing forecasts of population, employment, visitor counts and visitor spending for the state and counties. DBEDT issued a revised series of projections in 2009 to account for the recession. (More recent Census data and DBEDT projections suggest that the trend analysis remains valid, although population growth from 2000 to 2010 was greater than had been anticipated.)

- The City and County of Honolulu Department of Planning and Permitting's allocation of the 2009 DBEDT projections to community planning areas and sub-areas, taking into account local development policies, along with developers' activity and plans.

- Data on employment and wages compiled by the State Department of Labor and Industrial Relations for the state and county economies. Average salaries per industry in 2009 were used, and adjusted to 2011 values in line with changes in the cost of living:

	2009	*2011*
Construction	$65,460	$69,046
Retail	$27,573	$29,084
Real Estate/leasing	$42,687	$45,026
Accommodations	$33,517	$35,354
Food service	$16,136	$17,020
Arts/Recreation	$24,179	$25,504
Other services	$29,713	$31,341
All covered employment	$42,838	$45,185

("All covered employment" is an average for the entire island economy, and is used for wages in indirect and induced jobs.)

Construction jobs were estimated from the ratio of construction spending in the state economy to full-time construction jobs. The average ratio was 4.4 jobs per million dollars spent (based on data in the *State Data Book* from the 2007 Economic Census). Based on

industry trends, this was adjusted to cover the various types of construction in the Proposed Action and development alternatives as follows:

- Infrastructure/heavy construction: 3.8 jobs per million $
- Buildings 4.2 jobs per million $
- Single-family 4.5 jobs per million $

- Data on relations between income and taxes for both individuals and corporations, maintained by the State Department of Taxation. These ratios are cited in the notes to Tables 4-8 and 4-9.

- Real property tax rates for the year 2011-2012 in the City and County of Honolulu:
  - $3.50 per $1,000 in land or improved value for Residential property, and
  - $12.40 per $1,000 in land or improved value for Hotel and Resort property.

- Information about the visitor industry that has been compiled over many years by the Hawai‘i Visitors Bureau, the State Department of Business, Economic Development and Tourism, and the Hawai‘i Tourism Authority.

- Census data, from the American Community Survey conducted annually since 2005 and from the 2010 Census.

Additional specific assumptions used in this study are identified in the notes to particular tables.

A question of general concern for community stakeholders is whether timeshare and condominium hotel guests would support employment comparable to that of "full service hotels." The data are complex:

- Spending by hotel visitors can be higher, on a per person per day basis, than spending by condominium or time share visitors[52];

- Much of the difference lies in spending on lodging, spending which is not trip related in the case of condominium and time share-interval owners, and hence not counted in survey-based visitor spending analyses;

- Time shares have higher visitor occupancy rates in two senses: units are occupied more days of the year, and the number of persons per unit is higher in time shares than in hotels;

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[52] Hospitality Advisors LLC. *County of Maui: Summary Analysis of Economic and Social Impacts on Maui County from Timeshare Conversions: Final Report.* Honolulu, HI, 2006; Hawai‘i Tourism Authority, *2010 Annual Visitor Research Report.* Honolulu, HI 2011, posted at http://hawaii.gov/dbedt/info/visitor-stats/visitor-research/. The Hospitality Advisors study is valuable for two key reasons. By focusing on Maui, it deals with non-urban resorts, more comparable to TBR than either O‘ahu or Statewide samples, in which Waikīkī data predominate. Next, the study separates out lodging and non-lodging expenditures.

- At Turtle Bay Resort, the operators would need to establish their new products in competition with other Hawai‘i resorts, notably the new time share operations at Ko ‘Olina and Ka‘anapali. To do so, they would need to offer rewarding visitor experiences. The resort already includes a wide range of amenities, which would be refurbished and expanded.

Taking these factors into account, direct employment due to the resort expansion is estimated in two ways. On-site employment is estimated for new occupied units and new amenities based on their likely market position. (The overall positioning can be averaged as Deluxe for the Proposed Action; a mix of Standard and Deluxe for the Full Build-Out Alternative; and Luxury for the Conservation Partner Alternative and (for residential rentals) the Resort Residential Alternative.)[53] Off-site jobs supported by visitor expenditures are estimated from total estimated expenditure-supported jobs minus on-site jobs. The total expenditure figures take into account both resort market position and a discount factor for spending by time share and condominium visitors. (These assumptions are intended as conservative; with a rebound in market demand, spending and hence employment could be higher.)

Specific ratios for operations employment derived from unit construction and occupancy. Occupancy estimates were developed by Belt Collins Hawaii based on experience with Hawaii hotels and resorts:

Occupancy of new units		Persons per unit	Share of this product	Occupancy
Time Share		3.2	100%	90%
Condo	Owners	2.5	15%	30%
	Visitor pool	3.2	85%	50%
Resort Residential				
FT		2.5	5%	75%
PT	Owners	2.5	20%	30%
	Visitor pool	3.5	75%	50%

NOTES: “Occupancy” here refers to the share of the time that units are occupied by residents or visitors. Condos and resort residential units may be bought and held by owners for their own use, or made available for visitor rental as well as the owner’s use.

Community housing units were assumed to be 95% occupied (to allow for time when units are empty before residents move in). Occupied units were assumed to have an average household size of 4.2 persons per unit, based on 2010 Kahuku Census figures.

Taking occupancy into account, and sorting jobs according to whether they are highly sensitive to occupancy levels, the following rates were used for the Proposed Action:

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[53] See Hawai‘i Tourism Authority, *2011 Visitor Plant Inventory.* Honolulu, HI, 2012, page 88, posted at http://hawaii.gov/dbedt/info/visitor-stats/visitor-plant/2011VPI.pdf , for the classification of properties by rack rate. For this analysis, comparisons with several existing resort properties, rather than a classification scheme, were used.

	Jobs per Hotel unit	Jobs per Resort Residential unit
o Hotel	0.82	0.00
o Food and Beverage	0.21	0.01
o Retail	0.07	0.02
o Recreation Services	0.01	0.00
o Landscaping	0.01	0.015
o Security	0.01	0.015
o Realty/Management	0.02	0.03

As noted above, job ratios were adjusted on the basis of occupancy and spending assumptions for the different development alternatives.

B.1.2 Limitations of the Analysis

All monetary values used in the analysis are expressed in constant 2011 dollars, with earlier figures adjusted to 2011 dollars in proportion to changes in the Consumer Price Index for Honolulu. Consequently, the analysis excludes inflation. Information about phasing (and hence the costs and revenues associated with the project over time) is indicated for the Proposed Action by reporting annual development estimates; for the development alternatives, only full-occupancy and 2025 cumulative data are shown.

The timetables for construction follow from current estimates by TBR. For the Proposed Action and all development alternatives, the timing of construction would depend on market conditions affecting both capital markets and resort investment by individuals. The timetables for phasing used in this analysis should be seen as a general guide to future activity, not as binding on the developer.

The fiscal analysis depends on the assumptions that rates of taxation would not change, and that historic ratios of income to tax payments in Hawai‘i, for individuals and corporations, provide a guide to future taxes.

Real property values for land are estimated from the value of existing resort and residential property in the North Shore area. For buildings, value is estimated from approximate construction cost. Since real property assessment is based on market value, not replacement value, this could well underestimate taxable value and tax revenues.

Estimates of construction cost and sales have been averaged for all properties in each subdivision (such as “Resort Residential 1” in a particular development scenario) or hotel. Similarly, when land is developed, the change in land value for real property analysis is estimated on the basis of the new land value minus an average value for land in the resort that could be redeveloped, not on the recent valuation of the specific site within the resort. The accounts of real property values focus on development of new residential and hotel properties, since these involve the major construction costs and increases in land value.

Some possible cash flows have not been studied. They could involve additional construction costs and jobs, or additional tax revenues. They are largely excluded for lack of information about monetary values or timing. (For example, the resort could sell parcels to sub-developers who in turn would build and sell resort residential units. Such land sales are not included in the analysis. Again, many new hotel and resort residential properties would likely be resold during the period of the analysis, but such resales are not considered here.)

Estimates of on-site vs. off-site direct employment depend on assumptions about visitor spending and behavior. Information compiled and analyzed by state agencies provides information about average patterns of behavior and spending. On-site employment can be estimated from information and conservative assumptions about resort facilities and operations. The extent of off-site employment is identified as a residual. The location of off-site direct employment is not specified, although much of that employment could be in the region surrounding the resort.

On-site population estimates may deal with persons staying overnight (and hence count many residents, but few workers) or present at some time during the day (counting most workers, some residents). Estimates of average or future daytime populations take into account the draw of new facilities and the ability of existing resources (e.g., beaches and golf courses) to accommodate new demand, but they are not based on extensive surveys and counts.

This analysis was conducted to assess effects for the Turtle Bay Resort Supplemental Environmental Impact Statement in April 2012, and is not intended as an attestation of value for any other purpose.

While the alternatives vary greatly in size, and hence in the extent of their effects on employment, wages and revenues, they all result in positive net cash flows for the State of Hawai‘i and the City and County of Honolulu.