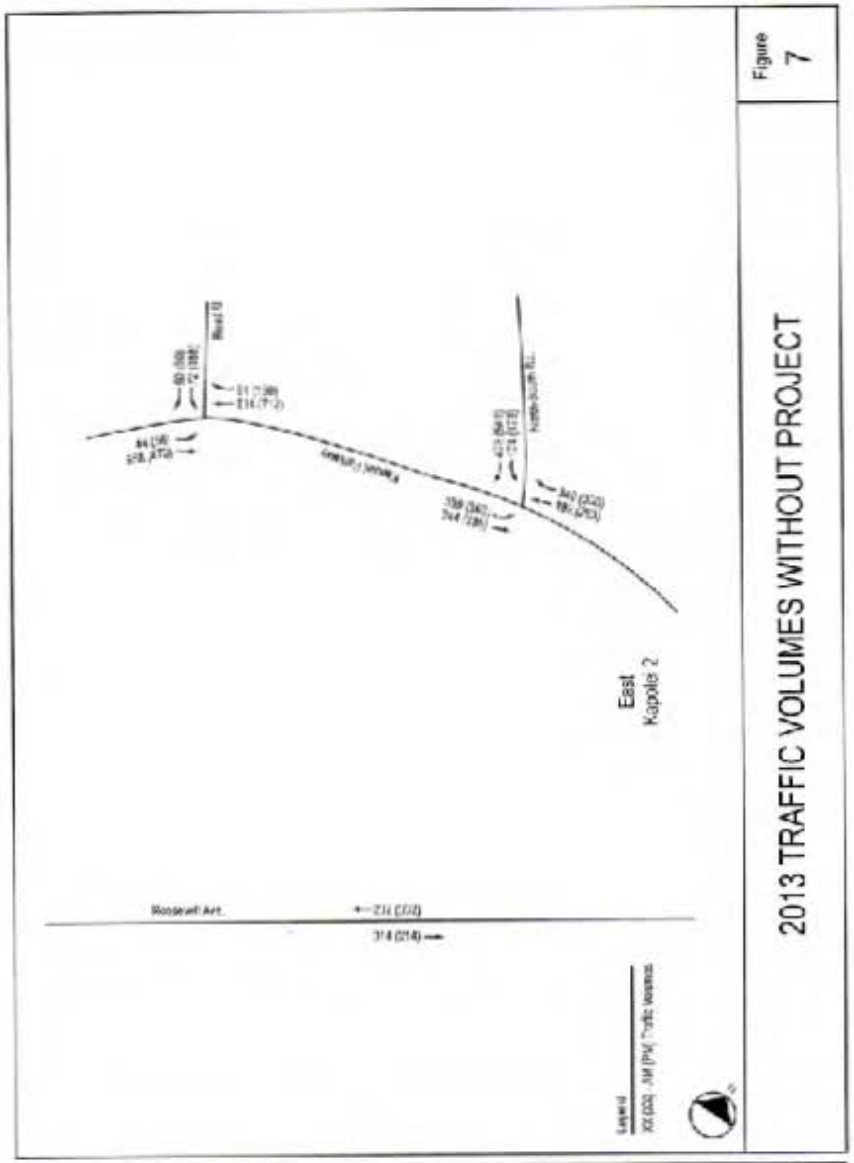


1. Kapolei Parkway/Road G

This intersection is projected to be a tee-intersection. A 150-second cycle is assumed. During the AM peak hour, the intersection is projected to operate at LOS A. During the PM peak, all movements are projected to operate at LOS C or better with the exception of the KKHD-bound Kapolei Parkway left turn, which is projected to operate at LOS D.

2. Kapolei Parkway/North-South Road

The intersection of Kapolei Parkway and North-South Road is expected to be a wide intersection with multiple double left turns. During the AM and PM peaks, the intersection is projected to operate at LOS C with all individual movements operating at LOS D or better.

D. Transit

As of this date, the western terminus first phase of the transit alignment, while not finalized, will not go beyond the East Kapolei Station near the Kroc Center. It is assumed that the alignment continuing down North-South Road will not be in place at this point.

E. Summary of 2013 Operations Without Project

The study area intersections are projected to operate at an acceptable level during the AM and PM peak hours. Both the Kapolei Parkway/North-South Road and Kapolei Parkway/Road G intersections experience consistent LOS D service in the PM peak hour. This is due primarily to control delay associated with the 150-second cycle length.

Table 2 Projected 2013 LOS Without Project

Intersection	AM Peak		PM Peak	
	LOS	Delay	LOS	Delay
Kapolei Parkway/Road G	**A**	**5.6**	**C**	**27.6**
Makai-bound Road G Left	B	12.7	B	11.6
Makai-bound Road G Right	B	11.8	B	10.4
Waianae-bound Kapolei Through	A	7.6	C	34.8
Waianae-bound Kapolei Right	A	6.7	C	28.0
KKHD-bound Kapolei Left	B	17.7	D	43.9
KKHD-bound Kapolei Through	A	3.0	C	21.8
Kapolei Parkway/North-South Road	**C**	**31.0**	**C**	**31.5**
Mauka-bound NSR Extension Left	D	50.7	D	53.2
Mauka-bound NSR Extension Through/Right	B	19.7	B	12.4
Makai-bound NSR Extension Left	D	44.7	D	48.4
Makai-bound NSR Extension Through	B	15.4	B	10.3
Makai-bound NSR Extension Right	B	10.1	B	11.3
Waianae-bound Kapolei Left	D	49.0	D	52.2
Waianae-bound Kapolei Through	D	41.5	D	47.9
Waianae-bound Kapolei Right	D	39.4	D	42.4
KKHD-bound Kapolei Left	D	44.8	D	52.3
KKHD-bound Kapolei Through/Right	C	30.9	D	43.7

Delay is expressed in seconds per vehicle

IV. PROJECTED 2013 CONDITIONS WITH PROJECT

The 2013 "With Project" scenario represents the future conditions within the project area with the Ka Makana Ali'i shopping center development. Similar assumptions were made for the "With Project" scenario. A connected Kapolei Parkway, North-South Road and the North-South Road extension, and the East-West Connector are all assumed to be in place in 2013.

A. Project-Related Traffic Volumes

Future traffic generated by the Ka Makana Ali'i shopping center was estimated using the three step method of trip generation, trip distribution, and trip assignment. The assumed land use and trip generation are shown in Table 3.

1. Trip Generation

Ka Makana Ali'i consists of three uses that can be classified as shopping center, office building, and hotel. Trip generation estimates the number of vehicular trips in and out of the project based on the land use type and density. Trips were estimated using trip generation equations published by the Institute of Transportation Engineers in Trip Generation, Seventh Edition.

Table 3 shows the planned project land use and corresponding trips generated. Pass-by traffic was assumed to be 20% during the PM while transit share was assumed to be 10%. Table 4 shows the actual number of new trips (calculated by subtracting pass-by trips and trips lost to transit from total trips generated) added to the roadway network.

Table 3 Ka Makana Ali'i Trip Generation

				AM Peak			PM Peak		
Land Use	Units		ITE Code	IN	OUT	TOTAL	IN	OUT	TOTAL
Shopping Center Total	1250000	SF	820	435	278	713	1592	1721	3313
Office Building Total	112000	SF	710	181	25	206	35	170	205
Hotel Total	300	Rooms	330	41	75	116	93	24	117
Project Total				**665**	**378**	**1035**	**1720**	**1915**	**3635**

Volumes expressed in vehicles per hour

Table 4 Ka Makana Ali'i Trip Generation: New Trips

Land Use	Units		ITE Code	AM Peak IN	AM Peak OUT	AM Peak TOTAL	PM Peak IN	PM Peak OUT	PM Peak TOTAL
Shopping Center Sub-Total	1247000	SF	820	435	278	713	1582	1734	3316
Shopping Center Transit Share	10%			-44	-28	-72	-158	-173	-331
Pass-By Traffic	20%						-318	-318	-636
Shopping Center Total				391	250	641	1115	1234	2349
Office Building Total	112300	SF	710	181	25	206	35	170	205
Hotel Sub-Total	300	Rooms	320	44	75	119	93	54	147
Hotel Transit Share	10%			-4	-8	-12	-9	-5	-14
Hotel Total				40	67	107	84	49	133
Project Total				612	342	954	1237	1403	2669

Volumes expressed in vehicles per hour

2 Trip Distribution

The shopping center distribution was calculated using projected 2014 land use data (in lieu of 2013 data, which was unavailable) from the Oahu model. The trip distribution is shown in Table 5. Farrington E and Farrington W refer to the traffic analysis zones (TAZs) located mauka of Farrington east and west of North-South Road.

Table 5 Ka Makana Ali'i Trip Distribution

Area	Household Total	
E. Kapolei 2	34	0.06%
Hoopili	6396	14.24%
UHWO	1892	4.21%
E. Kapolei 1	282	0.63%
Honouliuli	1836	4.09%
Ewa/Ewa Beach	17654	39.30%
Farrington E	1709	3.80%
Farrington W	86	0.19%
Kalaeloa	3318	7.39%
Kapolei	7759	17.27%
Villages of Kapolei	3954	8.80%
Total	44919	100%

3 Trip Assignment

The project-generated traffic volumes were assigned to the future network based using the trip distribution shown in Table 5. Negatives trips are associated with pass-by traffic. As an example, a vehicle heading east on Kapolei Parkway toward Ewa might choose to make the right turn into the shopping center and the right turn out when finished shopping. This vehicle is not a new trip; rather it is an existing trip that was rerouted. In this example, the pass-by trip manifests itself as a negative number for the through movement and an equivalent positive number for the right turn in and right turn out.

The trip assignment is shown in Figure 8. The projected 2013 traffic volumes with project are shown in Figure 9.

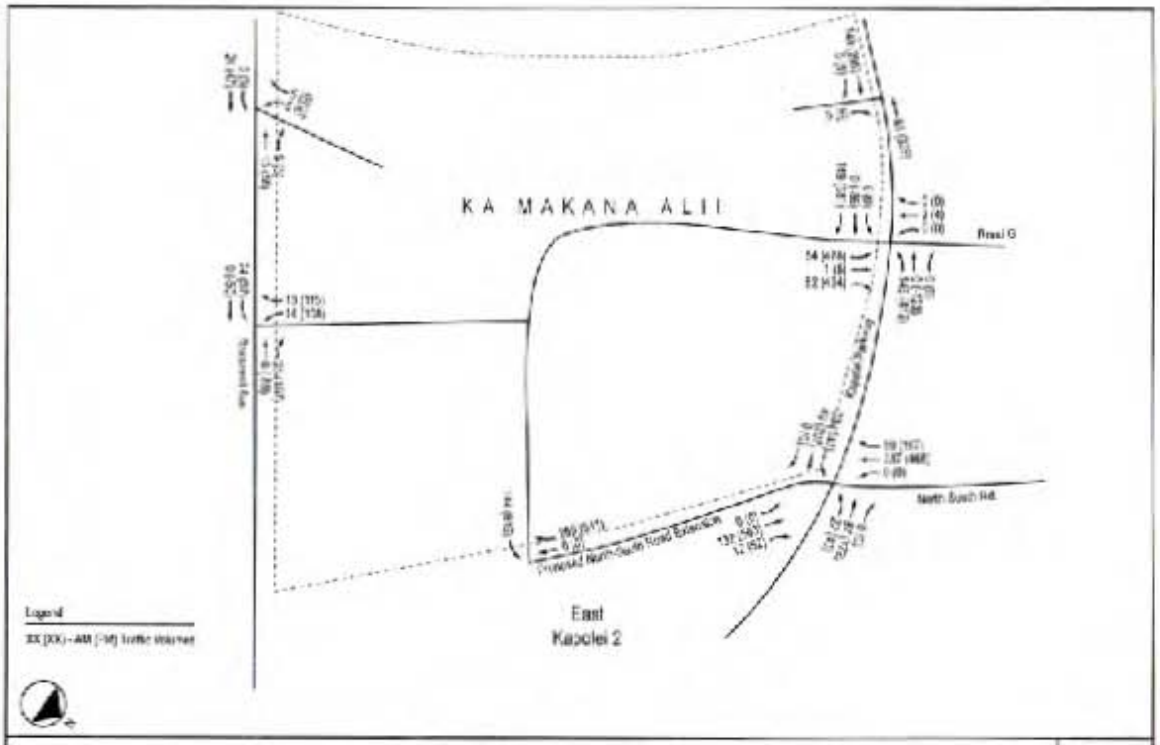
B. Projected 2013 Operations With Project

The projected 2013 intersection levels of service with the Ka Makana Ali'i shopping center are shown in Table 6.

Table 6 Projected 2013 LOS With Project

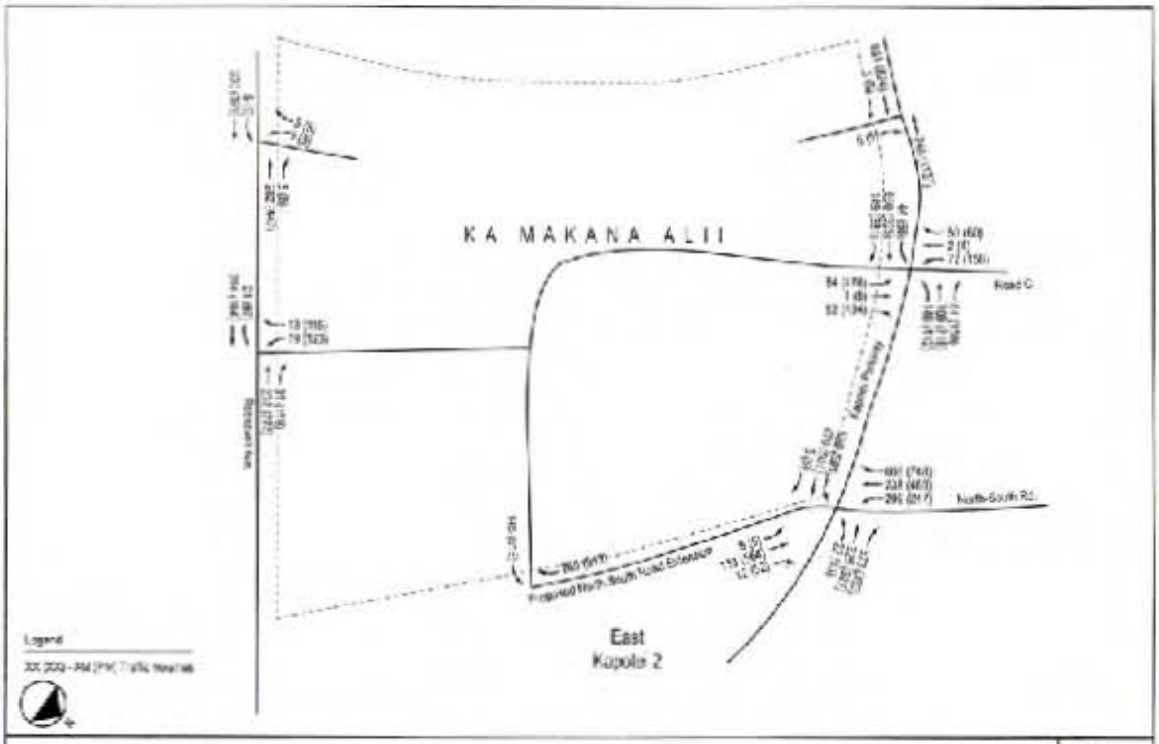
Intersection	AM Peak LOS	AM Peak Delay	PM Peak LOS	PM Peak Delay
Kapolei Parkway/Road G	**C**	**20.8**	**D**	**44.2**
Mauka-bound Road G Left	D	39.4	D	52.9
Mauka-bound Road G Through	C	20.3	C	26.5
Mauka-bound Road G Right	C	20.8	C	32.9
Makai-bound Road G Left	C	34.0	E	58.6
Makai-bound Road G Through/Right	B	18.4	C	31.6
Waianae-bound Kapolei Left	C	29.3	D	53.7
Waianae-bound Kapolei Through	B	10.5	D	37.0
Waianae-bound Kapolei Right	A	0.0	C	32.1
KKHD-bound Kapolei Left	D	43.8	E	62.3
KKHD-bound Kapolei Through	C	27.7	D	47.8
KKHD-bound Kapolei Right	C	21.6	D	44.2

Delay is expressed in seconds per vehicle



PROJECT-RELATED TRAFFIC VOLUMES

Figure 8



2013 TRAFFIC VOLUMES WITH PROJECT

Figure 9

Table 6 Projected 2013 LOS With Project (continued)

Intersection	AM Peak		PM Peak	
	LOS	Delay	LOS	Delay
Kapolei Parkway/North-South Road	**C**	**28.5**	**D**	**43.5**
Mauka-bound NSR Extension Left	D	44.1	F	128.4
Mauka-bound NSR Extension Through/Right	C	25.8	D	41.4
Makai-bound NSR Extension Left	D	37.2	E	67.8
Makai-bound NSR Extension Through	B	19.3	C	27.2
Makai-bound NSR Extension Right	B	16.6	C	26.7
Waianae-bound Kapolei Left	C	32.6	E	71.8
Waianae-bound Kapolei Through	C	26.0	E	58.9
Waianae-bound Kapolei Right	C	23.8	D	46.0
KKHD-bound Kapolei Left	C	20.4	F	64.1
KKHD-bound Kapolei Through/Right	A	3.9	C	29.2
Roosevelt Avenue/Ka Makana Ali'i Access	**B**	**17.7**	**B**	**14.2**
Makai-bound Ka Makana Ali'i Left	A	5.8	A	6.1
Makai-bound Ka Makana Ali'i Right	A	5.0	A	5.7
Waianae-bound Roosevelt Through	B	16.7	B	19.1
Waianae-bound Roosevelt Right	D	13.9	B	14.5
KKHD-bound Roosevelt Left	B	14.3	D	17.5
KKHD-bound Roosevelt Through	C	20.1	B	16.1
Kapolei Parkway Service Access	**Unsignalized**			
Mauka-bound Service Right	B	10.8	B	10.6
Roosevelt Avenue Service Access	**Unsignalized**			
Makai-bound Service Left	C	17.1	C	17.1
Makai-bound Service Right	B	11.3	B	11.2
KKHD-bound Roosevelt Left	A	8.4	A	8.4

Delay is expressed in seconds per vehicle

1. Kapolei Parkway/Road G

As shown in Figure 2, Ka Makana Ali'i has 3 major accesses, one to Kapolei Parkway at Road G, one on the North-South Road extension, and one to Roosevelt Avenue. Additional service accesses are located on the mauka-Waianae corner of the property adjacent to the drainage canal and on the makai-Waianae corner. The mauka Kapolei Parkway access is projected to be the primary access to serve Kalaeloa, Kapolei, and the Villages of Kapolei. It is also a primary access from Ewa/Ewa Beach and Hoopili. This being the case, the movements in and out of the shopping center are heavy movements. Double left turns out of the shopping center are recommended.

During the AM peak hour, all movements at the intersection are projected to operate at LOS C or better. During the PM peak hour, the intersection is projected to operate at LOS D, however, certain left turn movements are projected to operate at LOS E. LOS D overall with LOS E on left turn movements only is acceptable for this cycle length on a corridor like Kapolei Parkway.

Being the primary access to the shopping center resulting sizable increase in delay per vehicle with the project versus without.

2. Kapolei Parkway/North-South Road

As shown in Figure 2, the intersection of Kapolei Parkway and North-South Road is the major intersection within the study area. A cycle length of 150 seconds was assumed. During the AM peak, the intersection is projected to operate at LOS C overall. Protected left turns are projected to operate at LOS D or better during this time period. During the PM peak, the intersection is projected to operate at LOS D as well with all movements operating at LOS F or better. Like the Kapolei Parkway/Road G intersection, the long cycle length increases the overall delay. The KKHD-bound left turn is the key movement and utilizes a significant portion of green time.

3. Roosevelt Avenue/Makai Ka Makana Ali'i Access

Like the other non-primary Ka Makana Ali'i access, this intersection was analyzed using a 90-second cycle length and is projected to operate at LOS B during both the AM and PM peak hours.

4. Kapolei Parkway/Makai Ka Makana Ali'i Service Access

This intersection was analyzed as an unsignalized right in/right out access with stop control out of the shopping center. The mauka-bound service access is projected to operate at LOS B during both peak periods. This peak hour of activity at this service access is not expected to coincide with peak hour traffic on Kapolei parkway.

5. Roosevelt Avenue/Makai Ka Makana Ali'i Service Access

This intersection was analyzed as a full-movement access with stop control out of the shopping center. All movements are projected to operate at LOS C or better during both

C. Transit

As was mentioned earlier, the western terminus first phase of the transit alignment is projected to be at the East Kapolei Station near the Kroc Center. The alignment continuing down North-South Road is not projected to be in place in 2013. The impact of the transit will depend on the ridership and the associated park and ride lots at the Ewa/Kapolei stations.

D. Summary of 2013 Operations With Project

Overall the Ka Makana Ali'i shopping center has the greatest impact on the Kapolei Parkway/Road G intersection. This is understandable because the intersection would be improved from a tee intersection to a four-legged intersection, one approach of which would be the shopping center's primary access. The center also increases the delay at the Kapolei Parkway/North-South Road intersection but the LOS is unchanged. All other study area intersections are projected to operate acceptably.

V. CONCLUSION AND RECOMMENDATIONS

A. Conclusion

It is concluded that while delays experienced along Kapolei Parkway are expected to increase, the intersections are still projected to operate at an acceptable level during the AM and PM commuter peak hours. The Ka Makana Ali'i shopping center traffic can be accommodated by the adjacent roadway network.

B. Recommendations

Based on the operational analyses of intersections, the following are recommended to be implemented in conjunction with the proposed shopping center:

- Signalize the primary access on Kapolei Parkway using phasing that provides protected left turns on the minor streets.
- It is recommended that the adjacent intersections be configured as shown in Figure 10.
- Investigate the possibility of running a shuttle service between the future North-South Road transit station and the shopping center, particularly during the PM peak period.
- Provide frequent regional and sub-regional bus service connecting major activity centers in the area such as the UHWO campus and the Kroc center as well as with the transit stations in Waipahu and Kapolei.

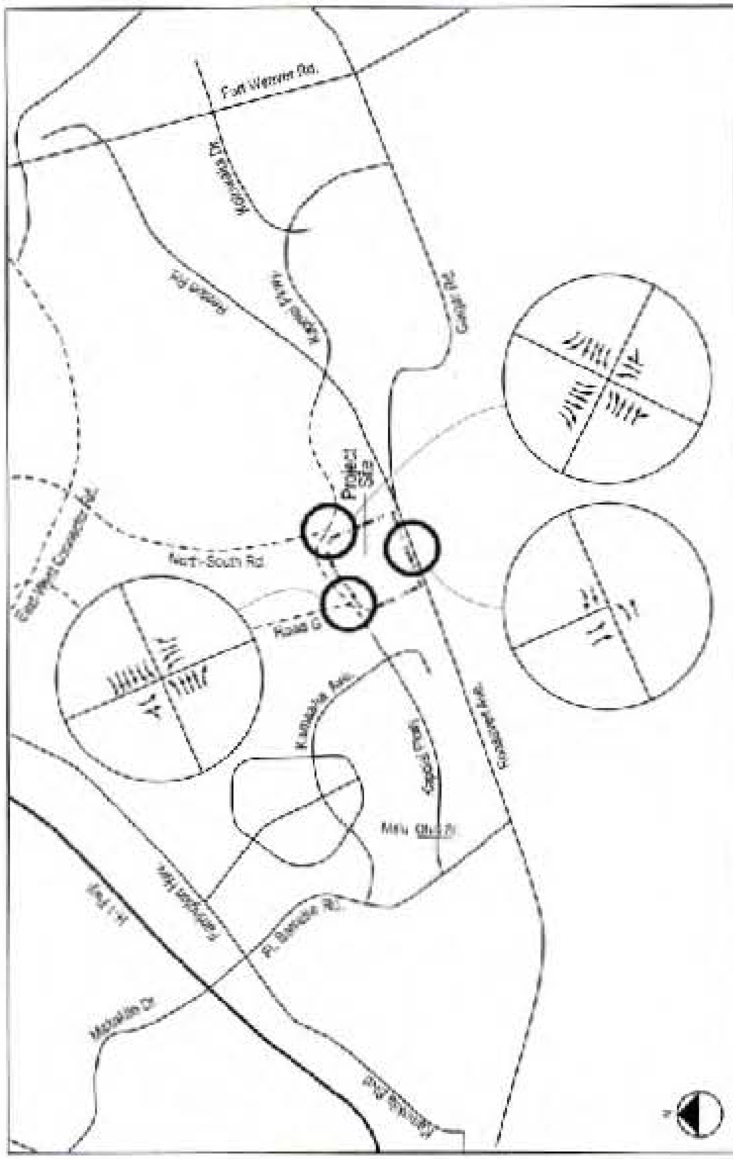


Figure 10

RECOMMENDED LANE CONFIGURATIONS

Draft

Appendix A

Existing Traffic Data

VEHICLE TURNING MOVEMENT COUNT - SUMMARY

Intersection of: Kapiolani Parkway
and: Ranson Road
Location: Kapiolani, Hawaii

Counted by: AB
Date: April 2, 2008
Weather: Sunny, 81
Entered by: AB

Day: Wednesday

Time	TRAFFIC FROM NORTH (on: Lunalilo Freeway)					TRAFFIC FROM SOUTH (on: Kapiolani Parkway)					TRAFFIC FROM EAST (on: Hector Road)					TRAFFIC FROM WEST (on: Ranson Road)					TOTAL (N + S + E + W)
	RIGHT	THRU	LEFT	U-TN	TOTAL	RIGHT	THRU	LEFT	U-TN	TOTAL	RIGHT	THRU	LEFT	U-TN	TOTAL	RIGHT	THRU	LEFT	U-TN	TOTAL	
AM																					
06:0-15	5	0	0	0	6	73	0	25	0	97	1	47	9	0	56	2	3	1	0	6	165
15-30	0	0	0	0	0	85	0	30	0	101	0	42	7	0	47	5	10	1	0	22	170
30-45	1	5	0	0	6	80	0	30	0	110	1	80	19	0	94	0	15	5	0	20	230
45-00	0	0	0	0	0	80	1	31	0	112	1	64	30	0	75	1	22	5	0	34	220
07:0-15	1	0	1	0	2	80	0	30	0	110	4	55	29	0	87	0	12	2	0	25	221
15-30	0	0	2	0	2	120	0	20	0	140	0	51	30	0	81	0	20	0	0	20	243
30-45	12	2	1	0	15	140	1	33	0	174	0	62	74	0	136	3	16	2	1	40	365
45-00	8	0	0	0	8	90	0	10	0	100	0	57	40	0	97	10	24	2	0	40	257
2 Hr Totals	31	9	4	0	44	761	2	282	0	1051	13	498	288	0	879	31	273	30	0	343	1925
1 Hr Totals																					
06-07	1	0	0	0	1	312	1	114	0	435	6	180	47	0	243	0	60	12	0	82	761
015-715	2	0	1	0	3	330	1	117	0	448	12	208	88	0	304	10	75	10	0	104	864
630-730	8	0	3	0	11	375	1	113	0	489	10	215	133	0	358	11	80	21	0	120	940
645-745	24	0	4	0	28	440	3	106	0	548	11	200	161	0	372	15	109	21	0	145	1093
07-08	30	0	4	0	34	434	1	88	0	523	4	213	218	0	435	25	110	17	0	152	1144
PEAK HOUR																					
07-08	31	0	4	0	35	391	1	88	0	520	4	113	213	0	430	25	110	12	0	158	1123
PM																					
3430-15	0	0	0	0	0	39	0	4	0	37	0	49	37	0	86	36	42	0	3	85	171
15-30	0	0	1	0	1	28	0	6	0	15	1	53	45	0	74	55	84	0	3	03	183
30-45	0	0	0	0	0	30	0	7	0	41	0	36	41	0	77	24	91	0	3	23	183
45-00	0	0	0	0	0	44	0	4	0	43	1	34	32	0	67	27	34	0	3	01	181
1700-15	0	1	0	0	1	33	0	7	0	47	0	26	30	0	65	19	38	0	3	57	165
15-30	2	1	0	0	1	41	0	12	0	53	0	23	37	0	60	34	10	0	0	54	163
30-45	3	0	0	0	0	37	0	7	0	44	0	24	32	0	56	23	45	1	0	70	173
45-00	3	0	0	0	0	29	0	10	0	34	0	27	35	0	72	21	23	0	0	54	142
2 Hr Totals	8	2	1	0	3	279	0	61	0	309	2	202	282	0	507	139	308	1	0	438	1347
1 Hr Totals																					
04-05	0	0	0	0	1	103	0	03	0	100	0	101	00	0	274	103	151	0	0	255	704
515-615	0	1	1	0	2	143	0	29	0	171	2	119	102	0	223	50	117	0	0	252	598
430-530	0	0	0	0	0	143	0	34	0	178	1	170	146	0	225	24	118	0	0	227	677
445-545	0	2	0	0	2	148	1	34	0	182	1	92	100	0	238	03	148	1	0	243	664
05-06	0	0	1	0	1	107	0	00	0	173	0	100	123	0	211	07	147	1	0	205	643
PEAK HOUR																					
0445	0	0	1	0	1	161	0	35	0	100	0	121	110	0	224	120	151	0	0	282	706

VEHICLE TURNING MOVEMENT COUNT - SUMMARY

Intersection of: Kapiolani Parkway
and: Kinoiki Avenue
Location: Kapiolani, Hawaii

Counted by: AB
Date: Mon-Oct, 2007
Weather: Sunny, Warm
Entered by: AB

Day: Tuesday

Time	TRAFFIC FROM NORTH (on: Kapiolani Parkway)					TRAFFIC FROM SOUTH (on: Kanaiolu Freeway)					TRAFFIC FROM EAST (on: Hector Parkway)					TRAFFIC FROM WEST (on: Nakoki Parkway)					TOTAL (N + S + E + W)
	RIGHT	THRU	LEFT	U-TN	TOTAL	RIGHT	THRU	LEFT	U-TN	TOTAL	RIGHT	THRU	LEFT	U-TN	TOTAL	RIGHT	THRU	LEFT	U-TN	TOTAL	
AM																					
06:0-15	10	15	12	2	63	0	54	6	1	32	6	0	0	0	37	1	00	1	0	00	130
15-30	16	22	18	5	174	1	00	10	2	31	6	7	1	0	01	4	11	0	0	15	200
30-45	15	31	21	0	111	1	69	11	0	41	10	10	0	0	22	10	02	0	0	24	240
45-00	17	27	25	0	119	2	05	10	0	00	07	14	1	0	32	10	21	7	0	10	200
07:0-15	05	31	37	0	102	2	03	25	0	110	07	10	2	0	13	10	25	05	0	30	241
15-30	10	02	00	0	104	4	07	27	0	110	01	00	0	0	04	05	23	01	0	00	221
30-45	01	00	47	0	107	1	120	17	0	100	07	10	0	0	00	24	24	00	0	00	077
45-00	05	04	40	0	100	1	03	00	0	01	00	00	2	0	07	00	24	11	0	117	004
2 Hr Totals	100	000	200	0	000	10	027	100	0	700	100	100	7	0	200	100	107	100	0	400	2400
1 Hr Totals																					
05-07	10	200	72	0	102	5	201	47	0	202	10	00	2	0	07	02	04	10	0	07	010
015-715	00	200	01	0	000	7	200	04	0	000	04	00	4	0	117	10	00	10	0	100	1270
600-700	01	107	110	0	000	10	000	00	0	400	07	00	2	0	100	07	01	00	0	100	1240
045-745	00	220	107	0	700	10	074	102	0	100	102	04	0	0	100	01	100	00	0	200	1477
07-08	07	110	110	0	000	0	007	100	0	407	100	10	0	0	200	100	110	110	0	000	1120
PEAK HOUR																					
07-08	07	110	110	0	000	0	007	100	0	407	100	00	0	0	200	100	110	110	0	000	1120
PM																					
3430-15	10	20	0	0	47	1	05	0	1	02	0	1	0	0	10	1	0	10	0	05	110
15-30	10	02	7	0	00	0	17	0	0	20	10	0	0	0	10	0	7	10	0	01	110
30-45	01	00	7	0	00	0	02	0	0	00	0	0	0	0	10	0	0	0	0	10	110
45-00	00	00	0	0	04	0	00	0	0	00	0	0	0	0	10	1	0	0	0	10	110
05:0-15	10	00	7	0	07	0	11	0	0	01	0	0	0	0	10	0	0	0	0	00	100
15-30	10	00	0	0	00	1	02	0	0	00	0	0	0	0	10	0	0	0	0	04	101
30-45	00	70	0	0	00	1	10	0	0	01	0	1	0	0	10	1	7	0	0	07	100
45-00	10	04	0	0	00	0	11	0	0	11	1	0	0	0	5	0	0	2	0	0	70
3 Hr Totals	100	000	07	0	000	4	100	00	1	100	00	00	0	0	04	00	07	74	1	100	000
1 Hr Totals																					
04-05	00	100	01	0	200	0	07	14	0	00	00	01	0	0	00	10	04	00	0	00	000
415-515	07	100	00	0	000	1	00	10	0	07	00	01	0	0	01	10	00	04	0	01	000
430-530	00	100	07	0	000	1	00	11	0	00	00	01	0	0	01	11	00	00	0	74	000
445-545	00	100	07	0	000	0	01	10	0	00	04	01	0	0	01	10	01	00	0	00	000
05-06	00	100	10	0	000	0	00	11	0	00	00	10	0	0	01	10	00	0	0	00	007
PEAK HOUR																					
04-05	00	100	01	0	000	0	07	14	0	00	00	01	0	0	00	10	04	00	0	00	000

Appendix B
Levels of Service Definitions

The *Highway Capacity Manual* defines six Levels of Service (LOS), labeled A through F, from best to worst conditions. Levels of Service for signalized and unsignalized intersections are defined in terms of average user delays. Delay is a measure of driver discomfort, frustration, fuel consumption, and lost travel time.

For unsignalized intersections, the *Highway Capacity Manual* evaluates gaps in the major street traffic flow and calculates available gaps for left-turns across oncoming traffic and for the left and right-turns onto the major roadway from the minor street.

LEVEL-OF-SERVICE A: Little or no delay.

LEVEL-OF-SERVICE B: Short traffic delays.

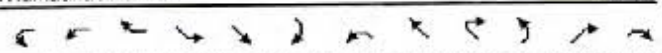
LEVEL-OF-SERVICE C: Average traffic delays.

LEVEL-OF-SERVICE D: Long traffic delays.

LEVEL-OF-SERVICE E: Very long traffic delays.

LEVEL-OF-SERVICE F: Demand volume exceeds capacity, resulting in extreme delays with queuing that may cause severe congestion and affect other movements at the intersection.

Appendix C
Intersection Capacity Analysis Worksheets



Movement	WBL	WBT	WBR	NBL	NBT	NBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	43	24	13	0	21	32	14	67	2	21	136	73
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
Hourly flow rate (vph)	47	26	14	0	23	35	15	73	2	23	148	79

Direction, Lane #	WB 1	WB 2	WB 3	NB 1	NB 2	SE 1
Volume Total (vph)	87	0	58	16	75	250
Volume Left (vph)	47	0	0	15	0	23
Volume Right (vph)	14	0	35	0	2	79
Hadj (s)	0.04	0.00	-0.39	0.52	0.01	-0.14
Departure Headway (s)	4.6	5.4	5.0	5.9	5.3	4.9
Degree Utilization, x	0.11	0.00	0.08	0.02	0.11	0.33
Capacity (veh/h)	737	651	697	579	630	616
Control Delay (s)	8.2	7.2	7.2	7.8	7.8	9.0
Approach Delay (s)	8.2	7.4		7.8		9.0
Approach LOS	A	A		A		A

Intersection Summary				
Delay	8.4			
HCM Level of Service	A			
Intersection Capacity Utilization	38.0%	ICU Level of Service		A
Analysis Period (min)	15			

Movement	NEL	NET	NER	SWL	SWT	SWR	NWL	NWT	NWR	SEL	SET	SER
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	5	85	118	152	319	97	106	367	9	110	113	103
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
Hourly flow rate (vph)	5	92	128	165	347	105	115	399	9	120	123	112

Direction, Lane #	NE 1	SW 1	SW 2	SW 3	NW 1	NW 2
Volume Total (vph)	226	165	452	115	406	354
Volume Left (vph)	5	165	0	115	0	120
Volume Right (vph)	128	0	105	0	9	112
Hadj (s)	-0.30	0.53	-0.13	0.53	0.02	0.05
Departure Headway (s)	8.5	9.0	8.3	8.9	8.4	8.1
Degree Utilization, x	0.54	0.41	1.04	0.28	0.95	0.80
Capacity (veh/h)	392	394	436	399	423	433
Control Delay (s)	21.0	17.0	83.0	14.2	59.6	36.1
Approach Delay (s)	21.0	55.4		49.5		36.1
Approach LOS	C	F		E		E

Intersection Summary				
Delay	48.7			
HCM Level of Service	E			
Intersection Capacity Utilization	73.6%	ICU Level of Service		D
Analysis Period (min)	15			

HCM Signalized Intersection Capacity Analysis
1: Kapolei Parkway & Road G

AM Peak Hour
7/13/2006

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	44	850	149	148	709	81	61	1	82	72	2	50
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	
Lane Util. Factor	1.00	0.91	1.00	0.97	0.91	1.00	0.97	1.00	1.00	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.85	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1770	5085	1583	3433	5085	1583	3433	1863	1583	1770	1583	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1770	5085	1583	3433	5085	1583	3433	1863	1583	1770	1583	
Peak hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	48	924	162	160	771	88	91	1	89	78	2	54
RTOR Reduction (vph)	0	0	121	0	0	66	0	0	65	0	37	0
Lane Group Flow (vph)	48	924	41	160	771	28	91	1	26	78	19	0
Turn Type	Prot		Perm	Prot		Perm	Prot		Perm	Prot		
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8			2			
Actuated Green, G (s)	3.8	18.9	18.9	9.0	24.3	24.3	4.1	19.9	19.9	7.2	23.0	
Effective Green, g (s)	3.6	18.9	18.9	9.0	24.3	24.3	4.1	19.9	19.9	7.2	23.0	
Actuated g/C Ratio	0.05	0.25	0.25	0.12	0.32	0.32	0.05	0.27	0.27	0.10	0.31	
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	55	1281	399	412	1649	513	158	494	420	179	489	
v/s Ratio Prot	0.03	c0.18		0.05	c0.15		c0.03	0.00		c0.04	0.01	
v/s Ratio Perm			0.03			0.02			c0.02			
v/c Ratio	0.96	0.72	0.10	0.39	0.47	0.05	0.58	0.00	0.06	0.46	0.04	
Uniform Delay, d1	34.9	26.6	21.5	30.5	23.2	17.5	34.4	28.3	30.5	32.1	18.2	
Progression Factor	1.00	1.00	1.00	0.65	0.51	0.65	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	53.3	2.0	0.1	0.8	0.2	0.0	2.9	0.0	0.3	2.0	0.1	
Delay (s)	103	27.7	21.6	20.3	12.0	11.4	37.4	28.3	30.8	34.0	18.4	
Level of Service	D	C	C	C	B	B	D	C	C	C	B	
Approach Delay (s)		27.6			11.2			28.6			27.5	
Approach LOS		C			B			C			C	

Intersection Summary			
HCM Average Control Delay	20.5	HCM Level of Service	C
HCM Volume to Capacity ratio	0.42		
Actuated Cycle Length (s)	75.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	43.7%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
2: Kapolei Parkway & NSR Extension

AM Peak Hour
7/13/2006

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	329	479	5	22	525	373	5	133	12	266	238	666
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0		5.0	5.0	5.0
Lane Util. Factor	0.97	0.91		0.97	0.95	0.88	1.00	0.88		0.97	0.95	0.88
Frt	1.00	1.00		1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	5078		3433	3539	2787	1770	3490		3433	3539	2787
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	5078		3433	3539	2787	1770	3490		3433	3539	2787
Peak hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	500	521	5	24	353	405	5	145	13	322	259	659
RTOR Reduction (vph)	0	1	0	0	0	317	0	10	0	0	0	449
Lane Group Flow (vph)	665	525	0	24	353	88	5	148	0	322	259	210
Turn Type	Prot			Prot		Perm	Prot			Prot		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases						8						6
Actuated Green, G (s)	14.0	24.8		5.5	16.3	16.3	0.8	10.9		9.7	23.0	23.0
Effective Green, g (s)	14.0	24.8		5.5	16.3	16.3	0.8	10.9		9.7	23.0	23.0
Actuated g/C Ratio	0.19	0.33		0.07	0.22	0.22	0.01	0.15		0.13	0.32	0.32
Clearance Time (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0		5.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	641	1679		252	788	508	19	509		444	1128	888
v/s Ratio Prot	c0.16	0.10		0.01	c0.10		0.00	c0.01		c0.09	0.07	
v/s Ratio Perm						0.03						c0.08
v/c Ratio	0.88	0.31		0.10	0.46	0.18	0.26	0.21		0.73	0.23	0.24
Uniform Delay, d1	29.7	18.7		33.4	25.5	23.7	35.8	26.1		31.4	18.8	18.8
Progression Factor	0.25	0.20		1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	13.1	0.1		0.2	2.4	0.1	7.3	0.7		5.8	0.5	0.6
Delay (s)	20.4	3.9		32.6	25.0	23.8	44.1	25.8		37.2	19.3	19.5
Level of Service	C	A		C	C	C	D	C		D	B	B
Approach Delay (s)		12.4			25.1			26.3			24.0	
Approach LOS		B			C			C			C	

Intersection Summary			
HCM Average Control Delay	20.8	HCM Level of Service	C
HCM Volume to Capacity ratio	0.61		
Actuated Cycle Length (s)	75.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	53.0%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	24	314	232	31	17	13
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	1.00	0.85	1.00	0.85
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1770	1863	1863	1583	1770	1583
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1770	1863	1863	1583	1770	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	26	341	252	34	18	14
RTOR Reduction (vph)	0	0	0	25	0	7
Lane Group Flow (vph)	26	341	252	9	18	7
Turn Type	Perm			Perm		Perm
Protected Phases		4	8		6	
Permitted Phases	4			8		6
Actuated Green, G (s)	14.5	14.5	14.5	14.5	28.1	28.1
Effective Green, g (s)	14.5	14.5	14.5	14.5	28.1	28.1
Actuated g/C Ratio	0.28	0.28	0.28	0.28	0.53	0.53
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	264	514	514	436	946	845
v/s Ratio Prot		c0.15	0.14		c0.01	
v/s Ratio Perm	0.01			0.01		0.00
v/c Ratio	0.10	0.66	0.49	0.02	0.02	0.01
Uniform Delay, d1	14.2	19.9	16.6	13.9	5.8	5.7
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.1	3.2	0.7	0.0	0.0	0.0
Delay (s)	14.3	23.1	17.3	13.9	5.8	5.8
Level of Service	B	C	B	B	A	A
Approach Delay (s)		19.7	16.4		5.8	
Approach LOS		B	B		A	

Intersection Summary			
HCM Average Control Delay	17.7	HCM Level of Service	B
HCM Volume to Capacity ratio	0.34		
Actuated Cycle Length (s)	52.6	Sum of lost time (s)	10.0
Intersection Capacity Utilization	31.4%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	0	1004	985	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0			
Lane Util. Factor		0.91	0.91			
Frt		1.00	1.00			
Flt Protected		1.00	1.00			
Satd. Flow (prot)		5085	5085			
Flt Permitted		1.00	1.00			
Satd. Flow (perm)		5085	5085			
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	1091	1071	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	0	1091	1071	0	0	0
Turn Type					custom	
Protected Phases		4	8			
Permitted Phases					6	
Actuated Green, G (s)		51.0	51.0			
Effective Green, g (s)		51.0	51.0			
Actuated g/C Ratio		0.68	0.68			
Clearance Time (s)		4.0	4.0			
Lane Grp Cap (vph)		3458	3458			
v/s Ratio Prot		c0.21	0.20			
v/s Ratio Perm						
v/c Ratio		0.32	0.29			
Uniform Delay, d1		4.6	4.5			
Progression Factor		0.14	1.51			
Incremental Delay, d2		0.2	0.2			
Delay (s)		0.9	7.1			
Level of Service		A	A			
Approach Delay (s)		0.9	7.1		0.0	
Approach LOS		A	A		A	

Intersection Summary			
HCM Average Control Delay	4.0	HCM Level of Service	A
HCM Volume to Capacity ratio	0.32		
Actuated Cycle Length (s)	75.0	Sum of lost time (s)	24.0
Intersection Capacity Utilization	22.7%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑↑			↑↑↑		↱
Volume (veh/h)	942	5	0	1259	0	5
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	1024	5	0	1368	0	5
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (ft)				531		
pX, platoon unblocked					0.96	
vC, conflicting volume			1029		1482	344
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			1029		1100	344
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		100	99
cM capacity (veh/h)			671		173	552

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	NB 1
Volume Total	410	410	210	456	456	456	5
Volume Left	0	0	0	0	0	0	0
Volume Right	0	0	5	0	0	0	5
cSH	1700	1700	1700	1700	1700	1700	652
Volume to Capacity	0.24	0.24	0.12	0.27	0.27	0.27	0.01
Queue Length 95th (ft)	0	0	0	0	0	0	1
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	10.6
Lane LOS							B
Approach Delay (s)	0.0			0.0			10.6
Approach LOS							B

Intersection Summary				
Average Delay		0.0		
Intersection Capacity Utilization	28.3%	ICU Level of Service		A
Analysis Period (min)	15			

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	↰	↑	↑↑		↰	↱
Volume (veh/h)	5	327	447	5	5	5
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	5	410	486	5	5	5
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)			1003			
pX, platoon unblocked						
vC, conflicting volume	491				909	486
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	491				909	486
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	99				98	99
cM capacity (veh/h)	1072				304	579

Direction, Lane #	EB 1	EB 2	WB 1	SB 1	SB 2
Volume Total	5	410	491	5	5
Volume Left	5	0	0	5	0
Volume Right	0	0	5	0	5
cSH	1072	1700	1700	304	579
Volume to Capacity	0.01	0.24	0.29	0.02	0.01
Queue Length 95th (ft)	0	0	0	1	1
Control Delay (s)	8.4	0.0	0.0	17.1	11.3
Lane LOS	A			C	B
Approach Delay (s)	0.1		0.0	14.2	
Approach LOS				B	

Intersection Summary				
Average Delay		0.2		
Intersection Capacity Utilization	33.8%	ICU Level of Service		A
Analysis Period (min)	15			

HCM Signalized Intersection Capacity Analysis
1: Kapolei Parkway & Road C

PM Peak Hour
7/15/2008

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	50	505	361	412	710	150	476	5	434	158	4	59
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	
Lane Util. Factor	1.00	0.91	1.00	0.97	0.91	1.00	0.97	1.00	1.00	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.86	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1770	6955	1583	3433	5085	1583	3433	1863	1585	1770	1800	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1770	6955	1583	3433	5085	1583	3433	1863	1585	1770	1800	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	61	549	414	448	280	163	526	5	472	172	4	55
RTOR Reduction (vph)	0	0	340	0	0	116	0	0	271	0	46	0
Lane Group Flow (vph)	61	549	74	448	280	47	526	5	196	172	23	0
Turn Type	Prot		Perm	Prot		Perm	Prot		Perm	Prot		
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8			2			
Actuated Green, G (s)	7.6	22.0	22.0	21.4	35.8	35.8	24.6	42.6	42.6	17.3	35.5	
Effective Green, g (s)	7.6	22.0	22.0	21.4	35.8	35.8	24.6	42.6	42.6	17.3	35.5	
Actuated g/C Ratio	0.06	0.18	0.18	0.17	0.29	0.29	0.19	0.35	0.35	0.14	0.29	
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	109	907	282	589	1470	469	668	644	547	245	466	
v/s Ratio Prot	0.03	c0.11		c0.13	0.15		c0.15	0.00		0.10	0.01	
v/s Ratio Perm			0.05			0.03			c0.12			
v/c Ratio	0.56	0.61	0.26	0.76	0.63	0.10	0.78	0.01	0.36	0.69	0.05	
Uniform Delay, d1	56.2	49.7	43.7	49.1	36.7	32.9	47.1	26.5	30.2	50.5	31.4	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	6.3	1.1	0.5	5.3	0.3	0.1	5.7	0.0	1.8	5.1	0.2	
Delay (s)	62.3	47.8	44.2	53.7	37.0	33.1	52.8	26.5	32.0	55.6	31.6	
Level of Service	E	D	D	D	D	C	D	C	C	E	C	
Approach Delay (s)		47.2			41.8			42.9			50.9	
Approach LOS		D			D			D			D	

Intersection Summary				
HCM Average Control Delay	44.2	HCM Level of Service	D	
HCM Volume to Capacity ratio	0.57			
Actuated Cycle Length (s)	123.3	Sum of lost time (s)	15.0	
Intersection Capacity Utilization	57.9%	ICU Level of Service	B	
Analysis Period (min)	15			
c Critical Lane Group				

HCM Signalized Intersection Capacity Analysis
2: Kapolei Parkway & NSR Extension

PM Peak Hour
7/15/2008

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	591	501	5	43	527	332	5	564	52	247	588	748
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0		5.0	5.0	5.0
Lane Util. Factor	0.97	0.91		0.97	0.95	0.88	1.00	0.95		0.97	0.95	0.88
Frt	1.00	1.00		1.00	1.00	0.85	1.00	1.00		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	5078		3433	3539	2787	1770	3464		3433	3539	2787
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	5078		3433	3539	2787	1770	3464		3433	3539	2787
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	642	545	5	47	573	361	5	613	57	268	639	813
RTOR Reduction (vph)	0	1	0	0	0	284	0	4	0	0	0	461
Lane Group Flow (vph)	642	549	0	47	573	77	5	666	0	268	639	352
Turn Type	Prot			Prot		Perm	Prot			Prot		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases						8						8
Actuated Green, G (s)	33.5	56.7		3.9	29.1	29.1	0.7	46.6		15.3	61.2	61.2
Effective Green, g (s)	33.5	56.7		3.9	29.1	29.1	0.7	46.6		15.3	61.2	61.2
Actuated g/C Ratio	0.22	0.39		0.03	0.21	0.21	0.00	0.33		0.11	0.43	0.43
Clearance Time (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0		5.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	740	1999		95	728	573	9	1151		371	1531	1205
v/s Ratio Prot	c0.19	0.11		0.01	c0.16		0.00	c0.19		c0.08	0.10	
v/s Ratio Perm						0.03						0.13
v/c Ratio	0.87	0.27		0.49	0.79	0.14	0.56	0.58		0.72	0.33	0.29
Uniform Delay, d1	83.8	39.2		67.8	83.5	45.0	70.2	39.3		61.9	28.0	26.1
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	16.5	0.1		4.0	5.5	0.1	58.1	2.1		5.8	0.6	0.5
Delay (s)	64.1	29.2		71.8	58.9	45.0	128.4	41.4		67.8	27.2	26.7
Level of Service	E	C		E	E	D	F	D		E	C	C
Approach Delay (s)		48.0			54.0			42.1			33.8	
Approach LOS		D			D			D			C	

Intersection Summary				
HCM Average Control Delay	43.6	HCM Level of Service	D	
HCM Volume to Capacity ratio	0.72			
Actuated Cycle Length (s)	141.6	Sum of lost time (s)	20.0	
Intersection Capacity Utilization	72.4%	ICU Level of Service	C	
Analysis Period (min)	15			
c Critical Lane Group				

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	97	164	273	119	123	115
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Fr	1.00	1.00	1.00	0.85	1.00	0.85
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1770	1863	1863	1583	1770	1583
Flt Permitted	0.47	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	874	1863	1863	1583	1770	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	105	178	297	129	134	125
RTOR Reduction (vph)	0	0	0	96	0	57
Lane Group Flow (vph)	105	178	297	34	134	68
Turn Type	Perm			Perm		Perm
Protected Phases		4	8		6	
Permitted Phases	4			8		6
Actuated Green, G (s)	13.4	13.4	13.4	13.4	28.1	28.1
Effective Green, g (s)	13.4	13.4	13.4	13.4	28.1	28.1
Actuated g/C Ratio	0.26	0.26	0.26	0.26	0.55	0.55
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	227	485	485	412	965	864
v/s Ratio Prot		0.10	c0.16		c0.08	
v/s Ratio Perm	0.12			0.02		0.04
v/c Ratio	0.46	0.37	0.61	0.08	0.14	0.08
Uniform Delay, d1	15.9	15.6	16.9	14.4	5.8	5.6
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.5	0.5	2.3	0.1	0.3	0.2
Delay (s)	17.5	16.1	19.1	14.6	6.1	5.7
Level of Service	B	B	B	B	A	A
Approach Delay (s)		16.6	17.7		5.9	
Approach LOS		B	B		A	

Intersection Summary			
HCM Average Control Delay	14.2	HCM Level of Service	B
HCM Volume to Capacity ratio	0.29		
Actuated Cycle Length (s)	51.5	Sum of lost time (s)	10.0
Intersection Capacity Utilization	39.1%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	0	1087	1288	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0			
Lane Util. Factor		0.91	0.91			
Frt		1.00	1.00			
Flt Protected		1.00	1.00			
Satd. Flow (prot)		5085	5085			
Flt Permitted		1.00	1.00			
Satd. Flow (perm)		5085	5085			
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	1182	1291	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	0	1182	1291	0	0	0
Turn Type						custom
Protected Phases		4	8			
Permitted Phases						6
Actuated Green, G (s)		16.0	16.0			
Effective Green, g (s)		16.0	16.0			
Actuated g/C Ratio		0.40	0.40			
Clearance Time (s)		4.0	4.0			
Lane Grp Cap (vph)		2031	2031			
v/s Ratio Prot		0.23	c0.27			
v/s Ratio Perm						
v/c Ratio		0.58	0.64			
Uniform Delay, d1		9.4	9.9			
Progression Factor		1.00	1.00			
Incremental Delay, d2		1.2	1.9			
Delay (s)		10.5	11.8			
Level of Service		B	B			
Approach Delay (s)		10.5	11.8		0.0	
Approach LOS		B	B		A	

Intersection Summary			
HCM Average Control Delay	11.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.64		
Actuated Cycle Length (s)	40.0	Sum of lost time (s)	24.0
Intersection Capacity Utilization	58.1%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑↑			↑↑↑		↱
Volume (vph)	942	5	0	1256	0	5
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	1024	5	0	1365	0	5
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (ft)				501		
pX, platoon unblocked					0.55	
vC, conflicting volume			1029		1682	344
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			1029		1672	344
tC, single (s)			4.1		5.5	6.5
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		100	99
cM capacity (veh/h)			671		100	662

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	NB 1
Volume Total	410	410	210	455	455	455	5
Volume Left	0	0	0	0	0	0	0
Volume Right	0	0	5	0	0	0	5
cSH	1700	1700	1700	1700	1700	1700	662
Volume to Capacity	0.24	0.24	0.12	0.27	0.27	0.27	0.01
Queue Length 95th (ft)	0	0	0	0	0	0	1
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	10.6
Lane LOS							B
Approach Delay (s)	0.0			0.0			10.6
Approach LOS							B

Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	28.3%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	↰	↑	↑↑		↰	↱
Volume (vph)	5	377	447	5	5	5
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	5	410	486	5	5	5
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)			1003			
pX, platoon unblocked	0.97				0.97	0.97
vC, conflicting volume	491				909	489
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	485				904	482
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	99				98	99
cM capacity (veh/h)	1058				307	584

Direction, Lane #	EB 1	EB 2	WB 1	SB 1	SB 2
Volume Total	5	410	491	5	5
Volume Left	5	0	0	5	0
Volume Right	0	0	5	0	5
cSH	1058	1700	1700	332	584
Volume to Capacity	0.01	0.24	0.29	0.02	0.01
Queue Length 95th (ft)	0	0	0	1	1
Control Delay (s)	8.4	0.0	0.0	17.1	11.2
Lane LOS	A			C	B
Approach Delay (s)	0.1		0.0	14.2	
Approach LOS				B	

Intersection Summary			
Average Delay	0.2		
Intersection Capacity Utilization	33.8%	ICU Level of Service	A
Analysis Period (min)	15		

Appendix B

2011 Traffic Evaluation Update

TRAFFIC EVALUATION

Ka Makana Alii

Ewa, Oahu, Hawaii

June 2011

Over a Century of Engineering Excellence

TRAFFIC EVALUATION

Ka Makana Alii

Ewa, Oahu, Hawaii

June 2011

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TABLE OF CONTENTS

TABLE OF APPENDICES

TABLE OF FIGURES

LIST OF TABLES

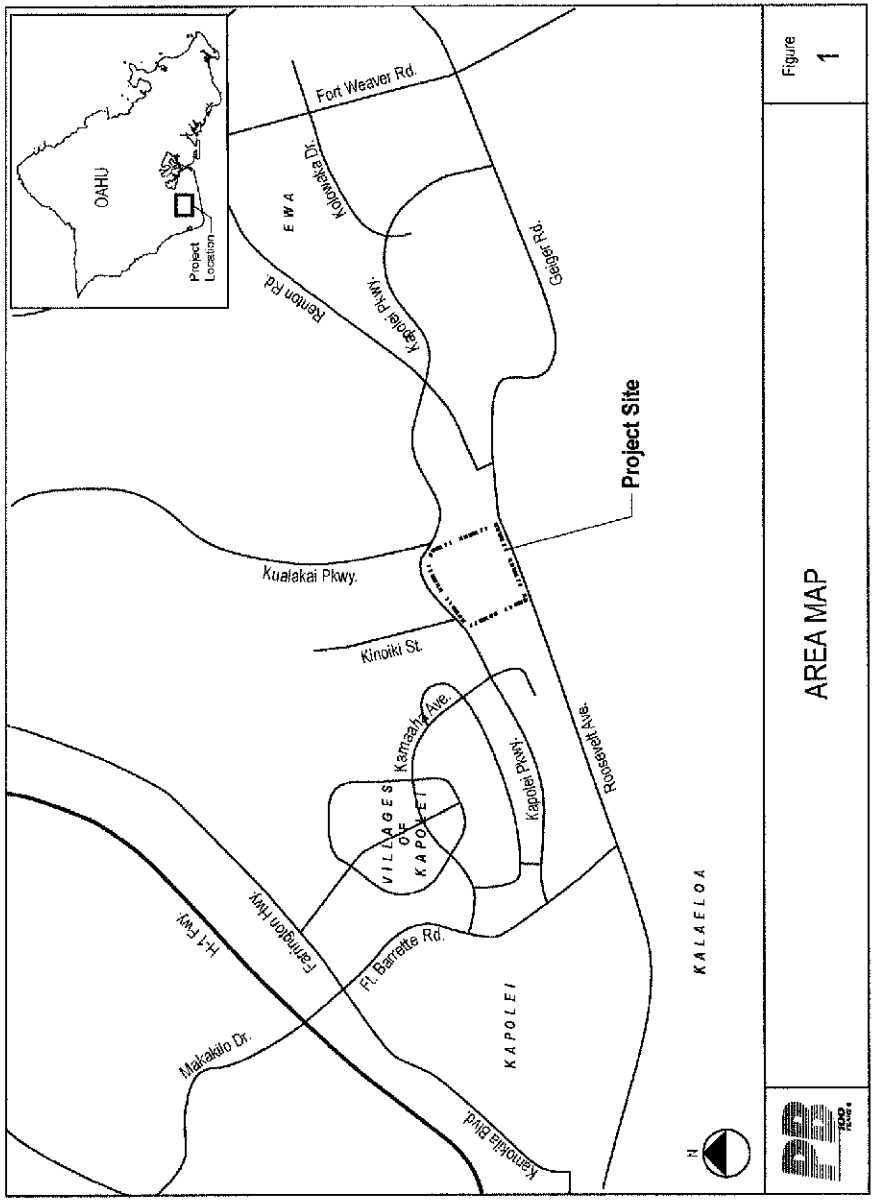
I. INTRODUCTION

The new Ka Makana Alii commercial development will be located in the heart of the rapidly growing Ewa plain. This includes the communities of Kapolei, Makakilo, Ko Olina, Ewa, Ewa Beach, and Kalaeloa. There are many planned developments proceeding through the planning, design, and construction phases in the area such as the East Kapolei residential communities planned by the State of Hawaii Department of Hawaiian Home Lands (DHHL), the University of Hawaii-West Oahu (UHWO) campus and adjacent development, Gentry Homes' Ewa by Gentry Makai, Haseko's Ocean Pointe, the Hawaii Community Development Authority (HCDA) Kalaeloa development, and Aina Nui Corporation's Kapolei, West Kapolei, and Makaiwa Hills developments. The proposed Kroc center is located mauka of Ka Makana Alii along North-South Road. A map of the area is shown in Figure 1.

Ka Makana Alii consists of Phase 1 and Phase 2, shown in Figures 2 and 3, respectively. Phase 1 consists of approximately 200,000 SF of retail commercial and will occupy the western portion of the project site. The primary access will be at Kinoiki Street. Phase 1 is projected to be completed in 2013. In Phase 2, the entire project site will be occupied and an additional access will be opened which will form the south leg at Kapolei Parkway/Kualakai Parkway. In addition to nearly 900,000 SF of retail commercial, Ka Makana Alii will include office and hotel land uses along with a movie theater.

Roadway infrastructure is a key concern in the area, and there are several major roadway projects that have been completed or are in progress to address this concern. The State of Hawaii Department of Transportation (HDOT) has constructed Kualakai Parkway (formerly North-South Road); in February 2010 as a new arterial roadway with a new interchange on Interstate H-1 Freeway. DHHL has constructed the segment of Kapolei Parkway between Kualakai Parkway and the Villages of Kapolei. Fort Weaver Road has also been recently widened. Fort Barrette Road widening is planned to be completed within the next 5 years. Phase 1 of the Kapolei Interchange project has been completed in early 2011.

The purpose of this report is to determine the impact of the Ka Makana Alii shopping center on the roadway network and to identify any improvements or mitigation needed to accommodate the development.



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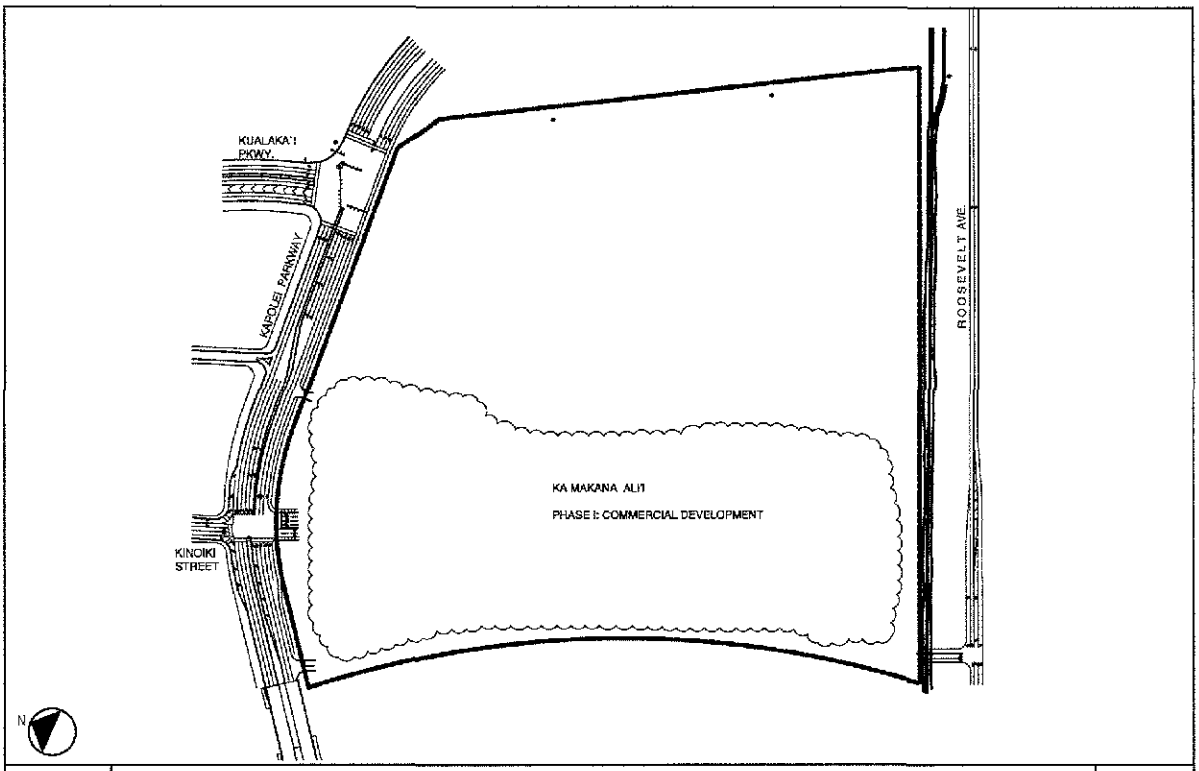
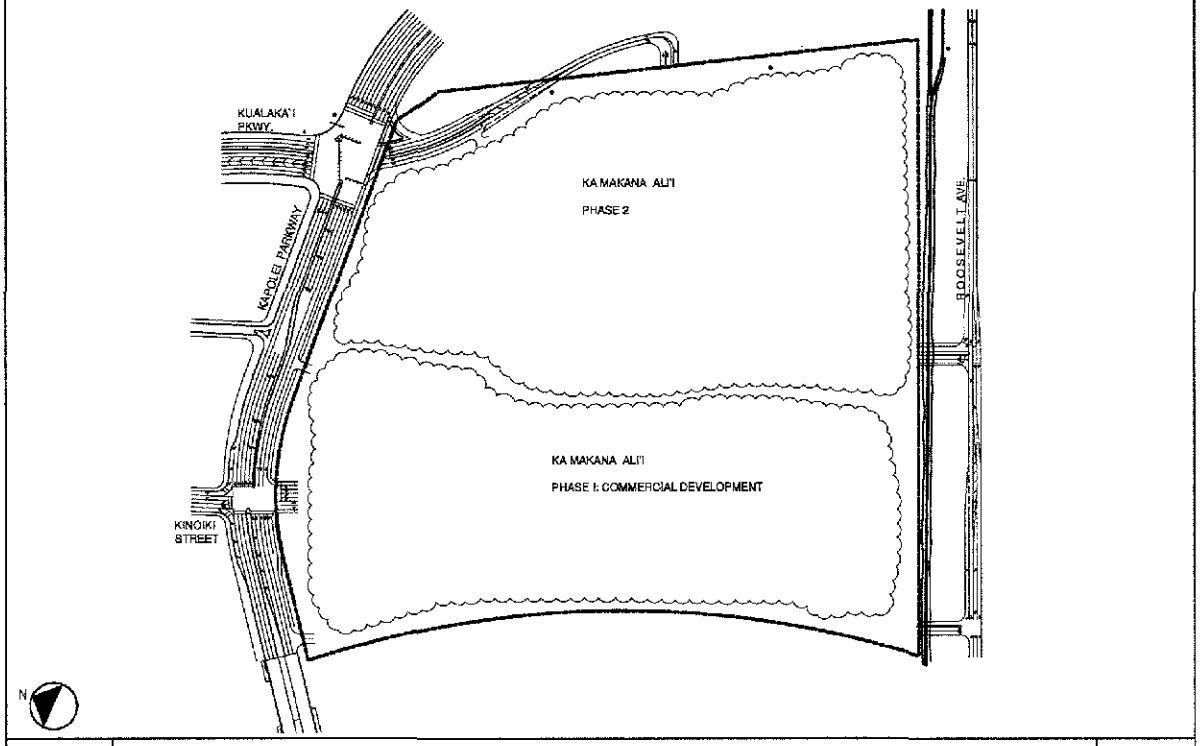


PROJECT SITE PLAN (Phase 1)

Figure 2

Ka Makana Ali'i
June 2011

PB Americas



PROJECT SITE PLAN (Phase 2)

Figure 3

Ka Makana Ali'i
June 2011

II. EXISTING CONDITIONS

The proposed Ka Makana Alii development is located makai of the intersection of Kapolei Parkway and Kualakai Parkway. Kualakai Parkway was opened in February of 2010. These intersections and their lane configurations are shown in Figure 4.

A. Existing Roadway Network

1. Kapolei Parkway

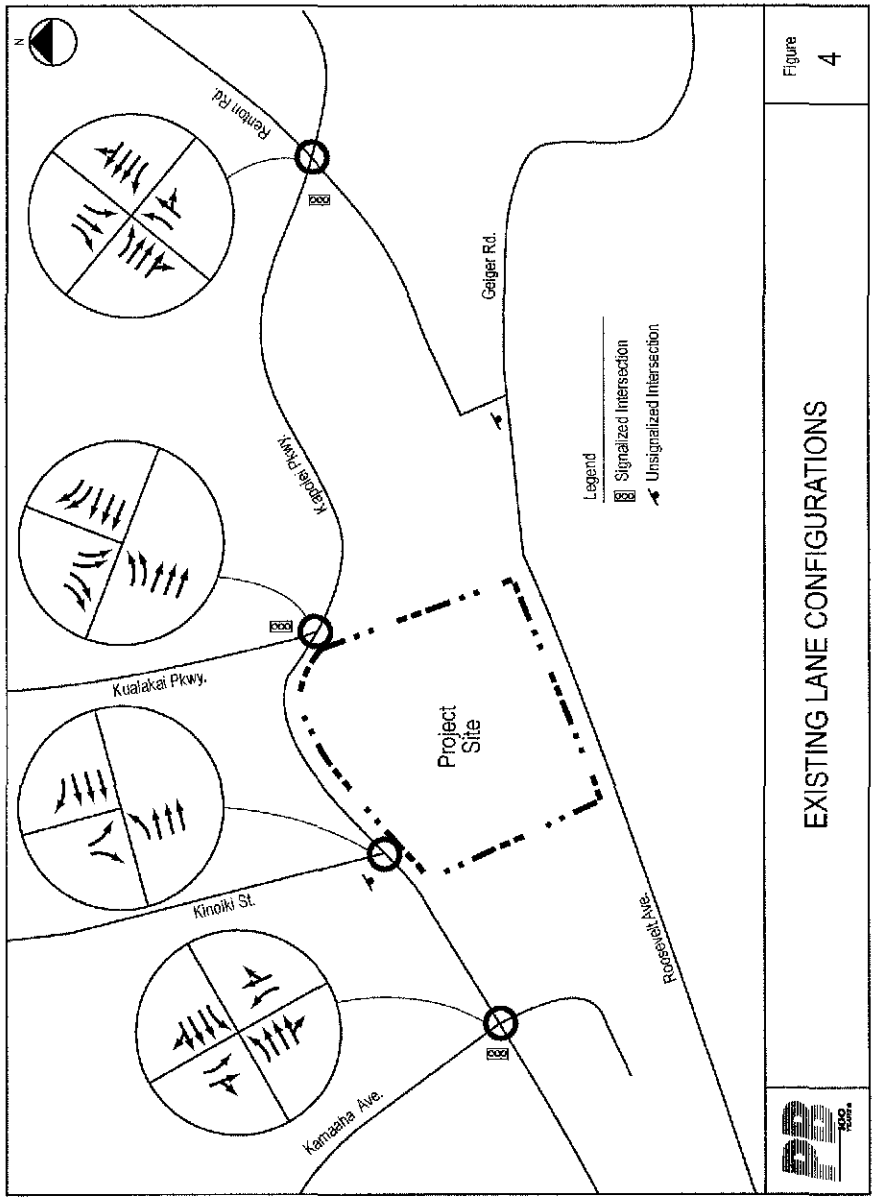
Kapolei Parkway is a six-lane, divided major arterial roadway. Ultimately it will provide significant east-west mobility between Kapolei and Ewa. Until 2010, Kapolei Parkway was discontinuous between Kapolei and Ewa. With the opening of Kualakai Parkway, Kapolei Parkway is now continuous between Fort Barrette Road and Papipi Road. The posted speed limit on Kapolei Parkway is 30 miles per hour.

2. Kualakai Parkway

Kualakai Parkway (formerly North-South Road) is a four-lane, divided major arterial roadway. While currently striped for four lanes, it will ultimately be six lanes. Kualakai Parkway connects Kapolei Parkway with H-1 Freeway at a diamond interchange. Its intersection with Farrington Highway is a major signalized intersection. Kualakai Parkway forms a signalized, tee-intersection at Kapolei Parkway. The speed limit on Kualakai Parkway is 35 miles per hour.

3. Roosevelt Avenue

Roosevelt Avenue is a collector roadway providing east-west circulation within Kalaeloa (former Barbers Point Naval Air Station. Roosevelt Avenue is a rural, two-lane undivided roadway with exclusive left-turn lanes at some intersections. The posted speed limit on Roosevelt Avenue is 35 miles per hour in the project vicinity. TheBus Route 41 serving Ewa Beach and East Kapolei runs through Roosevelt Avenue.



4. Kamaaha Avenue

Kamaaha Avenue is a four-lane, divided neighborhood collector roadway that provides access to the Villages of Kapolei development along with Kapolei Middle School. The speed limit on Kamaaha Avenue is 25 miles per hour.

5. Kinoiki Street

Kinoiki Street is a collector roadway providing access to the East Kapolei I. While currently terminating within East Kapolei I, Kinoiki Street will eventually continue north, meeting up with the future east-west collector road. The speed limit on Kinoiki Street is 25 miles per hour.

6. Renton Road

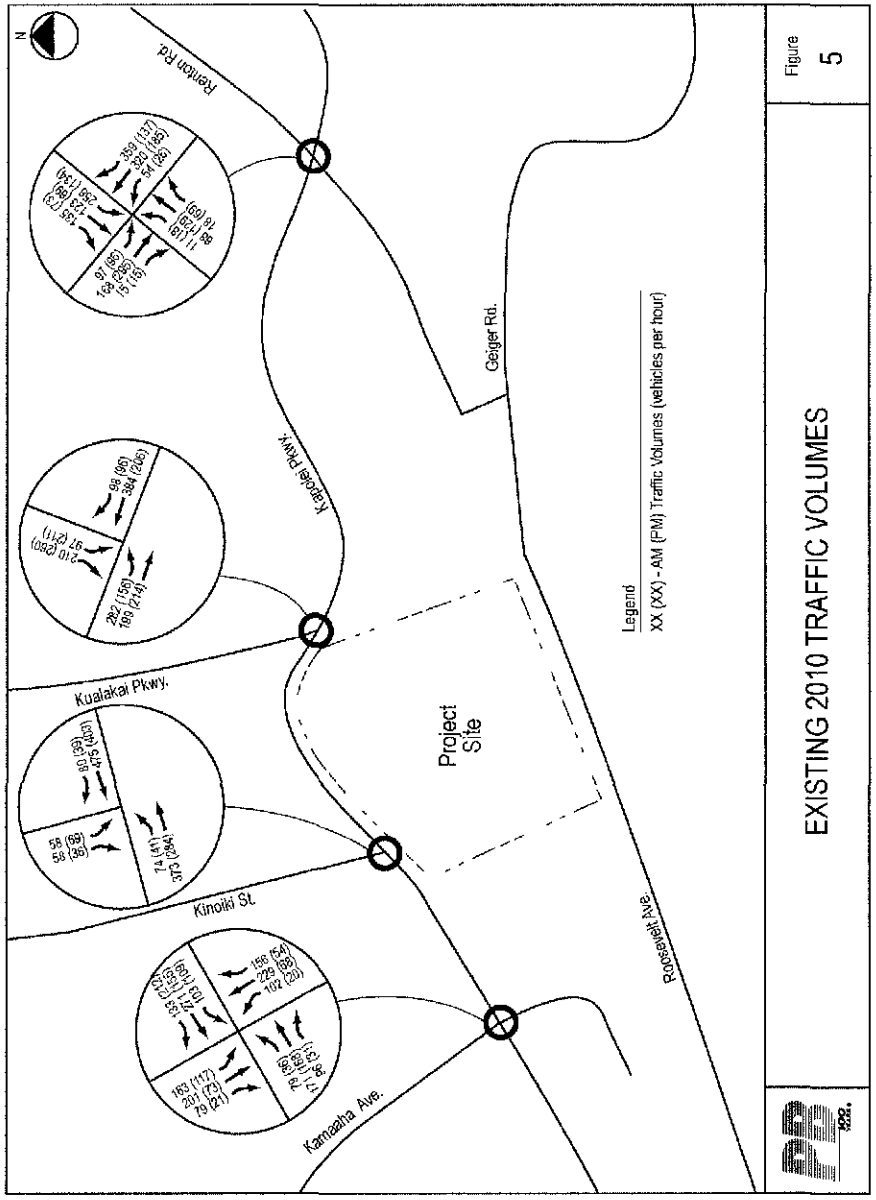
Renton Road is a four-lane, divided collector roadway providing east-west circulation and access within Ewa. Its western terminus is at a stop-controlled intersection with Roosevelt Avenue. It crosses both Kapolei Parkway and Fort Weaver Road, terminating just beyond Fort Weaver Road. The speed limit on Renton Road is 25 miles per hour.

B. Existing Traffic Volumes

Manual traffic counts were conducted on Tuesday, March 30, 2010 during the AM and PM peak periods at the following intersections:

- Kapolei Parkway/Kamaaha Avenue
- Kapolei Parkway/Kinoiki Street
- Kapolei Parkway/Kualakai Parkway
- Kapolei Parkway/Renton Road

The traffic volumes were then summarized into AM and PM peak hour volumes shown in Figure 5. The AM and PM peak hours were chosen to determine the effect of the shopping center on the periods of maximum congestion on two major Ewa arterials. The study AM and PM peak hours were 7:00-8:00 AM and 3:30-4:30 PM, respectively. Appendix A contains the traffic count data sheets.



C. Existing Traffic Operations

The study area intersections were analyzed using the methodologies for signalized and unsignalized intersections outlined in the 2000 Highway Capacity Manual (HCM). Operating conditions at an intersection are expressed as a qualitative measure known as Level of Service (LOS) with letter designations ranging from A through F, with LOS A representing free-flow conditions and LOS F representing over-capacity conditions. Level-of-Service criteria are described in Appendix B. Traffic analysis worksheets are located in Appendix C. The results of the intersection analysis are summarized in Table 1.

Table 1 Existing LOS

Existing	AM		PM	
	LOS	Delay	LOS	Delay
Kapolei Pkwy & Kamaaha Ave	**C**	**31**	**B**	**20**
Kapolei EB Left	D	42	C	31
Kapolei EB Through-Right	C	35	B	19
Kapolei WB Left	D	39	C	26
Kapolei WB Through-Right	C	33	B	16
Kamaaha NB Left	C	24	C	20
Kamaaha NB Through-Right	C	32	C	22
Kamaaha SB Left	D	38	C	26
Kamaaha SB Through-Right	B	12	B	11
Kapolei Pkwy & Kinoiki St	**Unsignalized**		**Unsignalized**	
Kapolei EB Left	A	9	A	8
Kinoiki SB Left	C	21	C	16
Kinoiki SB Right	A	10	A	9
Kapolei Pkwy & Kualakai Pkwy	**B**	**14**	**B**	**12**
Kapolei EB Left	B	16	B	16
Kapolei EB Through	A	4	A	6
Kapolei WB Through	B	15	B	14
Kapolei WB Right	B	17	B	13
Kualakai SB Left	B	17	B	13
Kualakai SB Right	B	16	B	13

Delay is expressed in seconds per vehicle

Table 1 Existing LOS (cont.)

Existing (continued)	AM		PM	
	LOS	Delay	LOS	Delay
Kapolei Pkwy & Renton Rd	**B**	**17**	**B**	**15**
Kapolei EB Left	C	25	B	20
Kapolei EB Through-Right	B	15	B	10
Kapolei WB Left	C	26	D	41
Kapolei WB Through-Right	B	17	B	14
Renton NB Left	B	12	B	14
Renton NB Through-Right	B	13	B	15
Renton SB Left	B	20	B	16
Renton SB Through	B	13	B	14
Renton SB Right	B	13	B	13

Delay is expressed in seconds per vehicle

1. Kapolei Parkway/Kamaaha Avenue

The intersection of Kapolei Parkway and Kamaaha Avenue has been signalized in the last few years. It was previously an all-way stop-controlled intersection. The northbound Kamaaha leg leads into the Villages of Kapolei development while the east Kapolei Parkway leg provides access to Kapolei Middle School. Due to the school, the intersection can be busy during the school-related peak periods. During the AM peak hour, the intersection operates at LOS C overall. All movements operate at LOS D or better. During the PM peak hour, the intersection operates at LOS B overall. All movements operate at LOS C or better.

2. Kapolei Parkway/Kinoiki Street

The intersection of Kapolei Parkway and Kinoiki Street is an unsignalized tee-intersection. The north Kinoiki leg leads to the East Kapolei I development. The southbound Kinoiki Street left turn operates at LOS C during both peak periods.

3. Kapolei Parkway/Kualakai Parkway

The intersection of Kapolei Parkway and Kualakai Parkway was opened in February of 2010. This intersection operates at LOS B during both peak hours with all individual movements operating at LOS B or better.

4. Kapolei Parkway/Renton Road

This intersection was formerly a four-legged intersection with stop control on the Renton Road approaches. With the last few years, it has been signalized. During the AM peak hour, the intersection operates at LOS B with all movements operating at LOS C or better. During the PM peak hour, the intersection operates at LOS B. The westbound Kapolei Parkway left turn operates at LOS D.

D. Summary of Existing Operations

Kualakai Parkway has been open for a little more than a year. The study area intersections operate at an acceptable LOS during both the AM and PM peak hours. As time passes and the region builds out, Kualakai Parkway will become a more attractive option to access H-1 Freeway.

III. PROJECTED 2013 CONDITIONS WITHOUT PROJECT

The base year 2013 represents future conditions within the project area without the Ka Makana Alii shopping center. No new roadways are projected to be constructed in the vicinity of the project.

A. Projected 2013 Network Without Project

1. Kapolei Parkway

Kapolei Parkway is projected to remain a six-lane major arterial connecting Kapolei at Kamokila Boulevard to Ewa, eventually winding its way makai toward Ewa Beach at its current terminus at Papipi Street. The intersections along Kapolei Parkway will typically require signals with protected left turns phases.

2. Kualakai Parkway

Kualakai Parkway is projected to remain a four-lane major arterial connecting H-1 Freeway to Kapolei Parkway at a tee-intersection.

3. Roosevelt Avenue

Roosevelt Avenue is projected to remain a two-lane collector roadway which would be deemphasized in the future. Its primary function would be to provide system redundancy as well as serving the Kalaeloa community.

4. Kinoiki Street

Kinoiki Street is a mauka-makai collector that runs through the planned University of Hawaii – West Oahu campus and East Kapolei Phase I, eventually connecting Farrington Highway and Kapolei Parkway. In 2013, it is assumed that it will not yet provide this connection.

Future developments in the Ewa plain are shown in Figure 6 (taken from the May 2009 Ewa Roadway Connectivity Study report). It was assumed that in 2013, East Kapolei I – Phase 2, East Kapolei II, the Kroc Center, and UH – West Oahu would be in place.

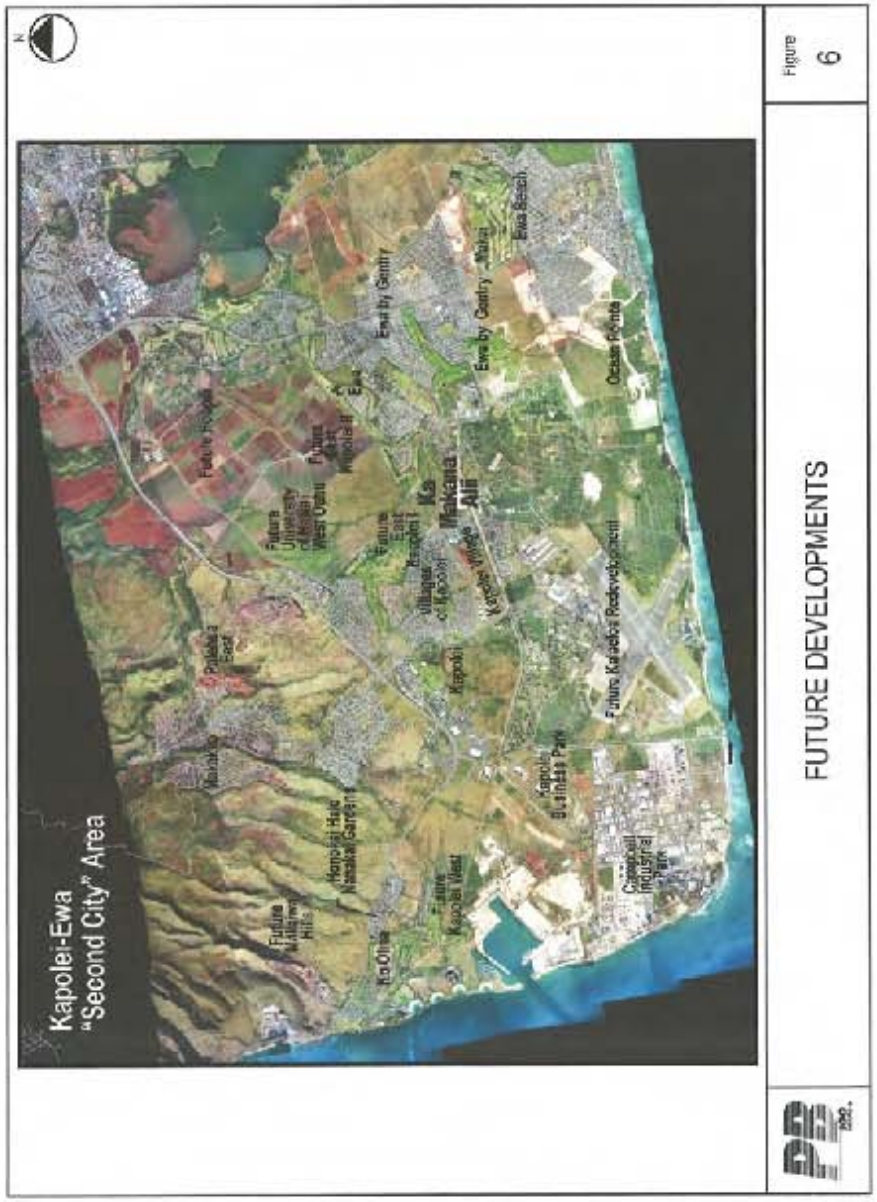


Figure 6

FUTURE DEVELOPMENTS

PB Americas

Ka Makana Ali'i
June 2011

B. Projected 2013 Traffic Without Project

The 2013 background traffic was estimated using data for the following developments.

- East Kapolei I – Phase 2
- East Kapolei II
- University of Hawaii – West Oahu
- Kroc Center

With Kapolei Parkway and Kualaka'i Parkway in place, traffic volumes were shifted from Farrington Highway and Roosevelt Avenue. Furthermore, annual growth was applied. Finally trips associated with the East Kapolei Phase I and Kroc Center developments were generated using trip generation equations published by the Institute of Transportation Engineers in Trip Generation, Eighth Edition.

The projected 2013 traffic turning movement volumes without project are shown in Figure 7.

C. Projected 2013 Operations Without Project

The projected 2013 intersection level of service without the Ka Makana Ali'i shopping center are shown in Table 2.

1. Kapolei Parkway/Kamaaha Avenue

The intersection of Kapolei Parkway and Kamaaha Avenue is projected to operate at LOS C during the AM peak. All movements are projected to operate at LOS C or better. During the PM peak hour, the intersection is projected to operate at LOS C overall as well. All individual movements are projected to operate at LOS C or better.

2. Kapolei Parkway/Kinoiki Street

The existing intersection of Kapolei Parkway and Kinoiki Street is an unsignalized tee intersection. In order to provide an accurate comparison between the with and without-project scenarios, it was analyzed as a signalized intersection in both cases. The intersection is projected to operate at LOS B during both the AM and PM peak hours.

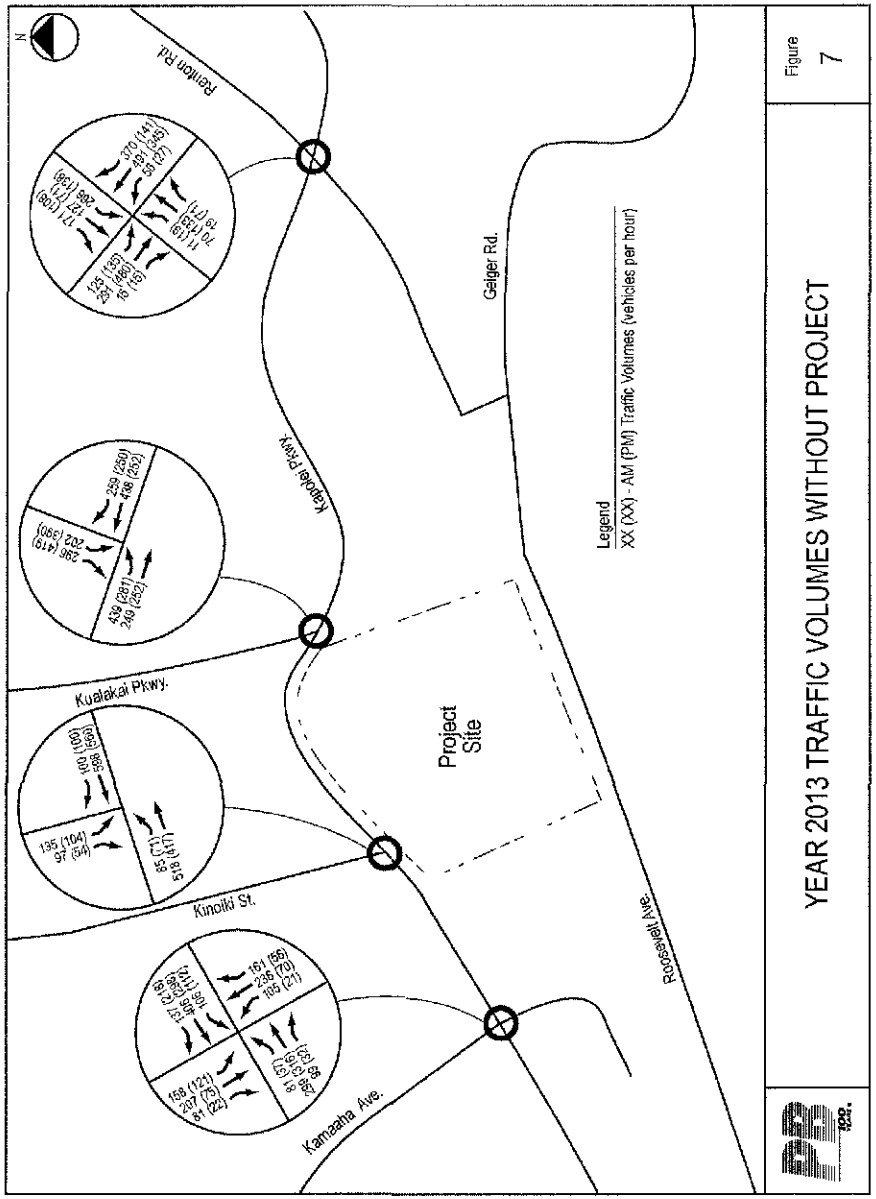


Table 2 Projected 2013 LOS Without Project

2013 background	AM		PM	
	LOS	Delay	LOS	Delay
Kapolei Pkwy & Kamaaha Ave	**C**	**34**	**C**	**22**
Kapolei EB Left	D	47	C	33
Kapolei EB Through-Right	D	37	C	24
Kapolei WB Left	D	42	C	28
Kapolei WB Through-Right	C	35	B	19
Kamaaha NB Left	C	27	C	25
Kamaaha NB Through-Right	D	37	C	27
Kamaaha SB Left	D	42	C	27
Kamaaha SB Through-Right	B	14	B	14
Kapolei Pkwy & Kinoiki St	**B**	**12**	**B**	**12**
Kapolei EB Left	C	21	B	20
Kapolei EB Through	A	6	A	5
Kapolei WB Through	B	15	B	14
Kapolei WB Right	B	13	B	12
Kinoiki SB Left	B	18	B	17
Kinoiki SB Right	B	16	B	15
Kapolei Pkwy & Kualakai Pkwy	**B**	**17**	**B**	**17**
Kapolei EB Left	B	19	B	20
Kapolei EB Through	A	5	A	6
Kapolei WB Through	B	18	B	18
Kapolei WB Right	B	18	B	20
Kualakai SB Left	C	21	B	18
Kualakai SB Right	B	20	B	17
Kapolei Pkwy & Renton Rd	**C**	**24**	**B**	**17**
Kapolei EB Left	C	33	C	23
Kapolei EB Through-Right	B	16	B	12
Kapolei WB Left	D	38	C	33
Kapolei WB Through-Right	C	24	B	18
Renton NB Left	B	20	B	17
Renton NB Through-Right	C	21	B	20
Renton SB Left	C	30	C	22
Renton SB Through	C	21	B	18
Renton SB Right	C	20	B	17

Delay is expressed in seconds per vehicle

3. Kapolei Parkway/Kualakai Parkway

The intersection of Kapolei Parkway and Kualakai Parkway is projected to operate at LOS B during both peak hours. All individual movements are projected to operate at LOS C during the AM peak hour and at LOS B or better during the PM peak hour.

4. Kapolei Parkway/Renton Road

The intersection of Kapolei Parkway and Renton Road is projected to operate at LOS C during the AM peak hour. Left turn movements are projected to operate at LOS D or better. During the PM peak hour, the intersection is projected to operate at LOS B overall with all movements operating at LOS C or better.

D. Summary of 2013 Operations Without Project

The study area intersections are projected to operate at an acceptable level during the AM and PM peak hours. All study area intersections are projected to operate at LOS B or C overall during the AM and PM peak hours.

IV. PROJECTED 2013 CONDITIONS WITH PHASE 1

The 2013 "With Project" scenario represents the future conditions within the project area with Phase 1 of the Ka Makana Alii shopping center development, shown in Figure 2. As shown, Ka Makana Alii would have a main access to Kapolei Parkway and a secondary access to Roosevelt Avenue. An additional right-in/right-out access is also planned on Kapolei Parkway at the northwestern corner of the property which would be used primarily as a service access but would also provide an additional driveway to alleviate pressure on other accesses. The same roadway assumptions were made for this scenario. Kualakai Parkway is assumed to form a tee-intersection with Kapolei Parkway.

A. Project-Related Traffic Volumes

Future traffic generated by the Ka Makana Alii shopping center was estimated using the three step method of trip generation, trip distribution, and trip assignment.

1. Trip Generation

Phase 1 of Ka Makana Alii consists of a shopping center land use. Trip generation estimates the number of vehicular trips in and out of the project based on the land use type and density. Trips were estimated using trip generation equations published by the Institute of Transportation Engineers in Trip Generation, Eighth Edition.

Table 3 shows the trips generated. Pass-by traffic was assumed to be 20% during the PM while transit share was assumed to be 7%.

Table 3 Ka Makana Alii Phase 1 Trip Generation

		AM Peak Hour			PM Peak Hour		
		In	Out	Total	In	Out	Total
RETAIL							
820	Shopping Center	143	91	234	501	521	1,022
	Mode Reductions	0	0	0	35	36	71
	Pass-by Traffic Reductions	0	0	0	100	104	204
	After Mode Reductions	143	91	234	401	417	818
Subtotal Trips (Before Mode Reductions)		143	91	234	501	521	1,022
Total Mode Reductions		0	0	0	135	140	275
Total External Trips		**143**	**91**	**234**	**366**	**381**	**747**

Volumes expressed in vehicles per hour

2. Trip Assignment

The shopping center distribution was calculated according to the Oahu Metropolitan Planning Organization model. The project-generated traffic volumes were assigned to the future network based using this trip distribution. The project-generated trips are shown in Figure 8. The projected 2013 traffic volumes with Phase 1 are shown in Figure 9.

B. Projected 2013 Operations With Project

The projected 2013 intersection level of service with Phase 1 of the Ka Makana Alii shopping center are shown in Table 4.

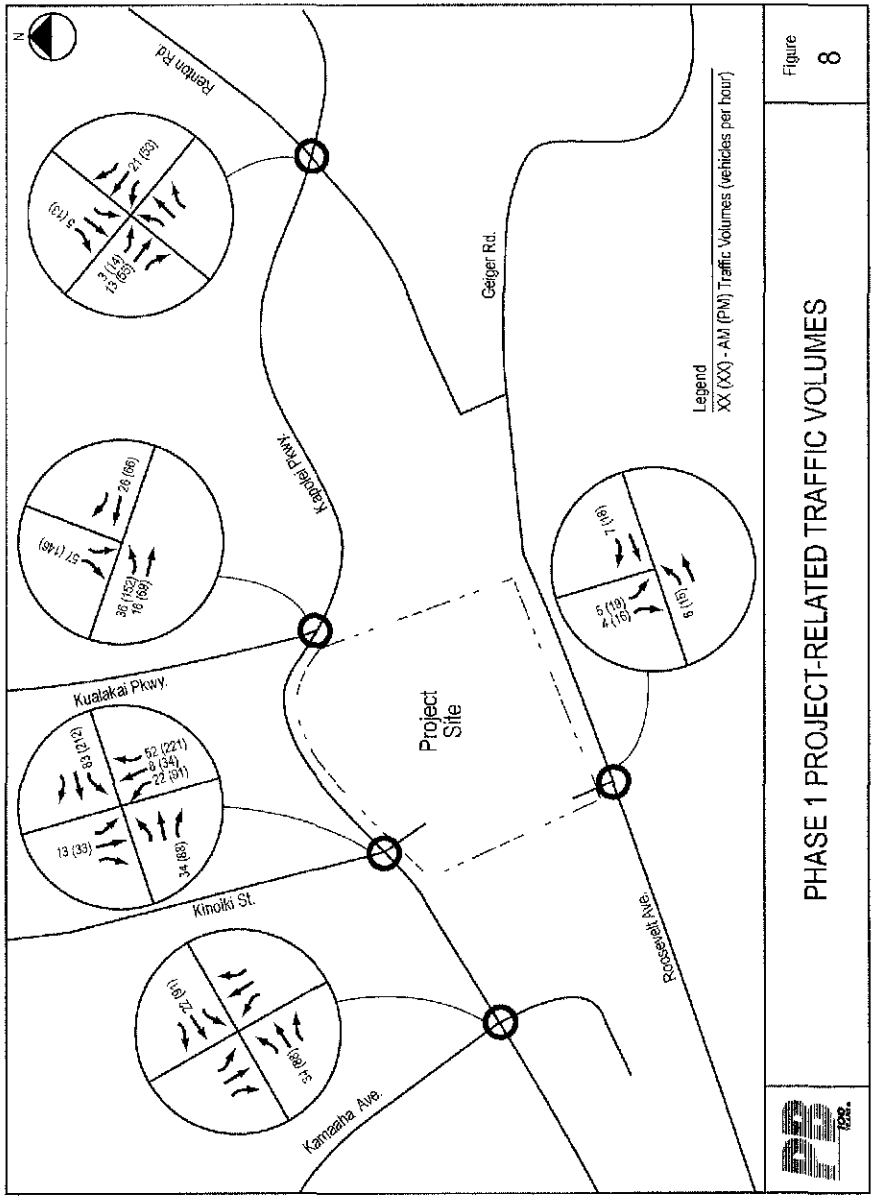
1. Kapolei Parkway/Kamaaha Avenue

The intersection of Kapolei Parkway and Kamaaha Avenue is projected to operate at LOS C during the AM peak. All movements operate at LOS D or better. During the PM peak hour, the intersection is projected to operate at LOS C overall as well. All individual movements are projected to operate at LOS C or better.

2. Kapolei Parkway/Kinoiki Street

The existing intersection of Kapolei Parkway and Kinoiki Street is an unsignalized tee-intersection. Phase 1 of Ka Makana Alii is projected to access Kapolei Parkway at Kinoiki Street, forming a signalized cross intersection. The movements in and out of the shopping center are heavy movements. Double left turns into and out of the shopping center are recommended.

The intersection is projected to operate at LOS C during both the AM and PM peak hours. During the AM peak hour, all movements are expected to operate at LOS D or better. During the PM peak hour, all movements are projected to operate at LOS C or better.



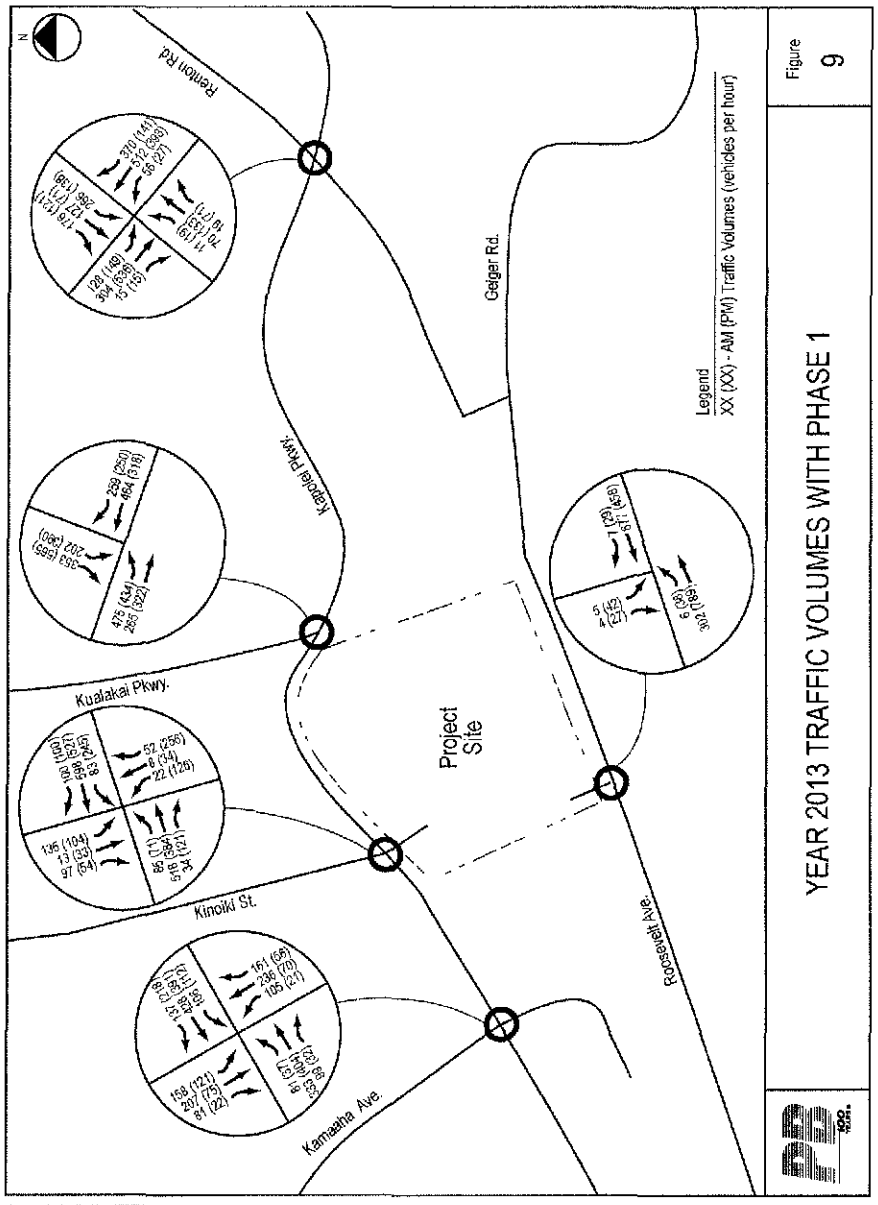


Table 4 Projected 2013 LOS With Project

Total 2013 with Phase 1	AM		PM	
	LOS	Delay	LOS	Delay
Kapolei Pkwy & Kamaaha Ave	**C**	**34**	**C**	**23**
Kapolei EB Left	D	47	C	34
Kapolei EB Through-Right	D	37	C	24
Kapolei WB Left	D	43	C	29
Kapolei WB Through-Right	C	35	B	19
Kamaaha NB Left	C	27	C	26
Kamaaha NB Through-Right	D	37	C	29
Kamaaha SB Left	D	43	C	29
Kamaaha SB Through-Right	B	14	B	15
Kapolei Pkwy & Kinoiki St	**C**	**24**	**C**	**24**
Kapolei EB Left	C	32	C	30
Kapolei EB Through	C	22	C	24
Kapolei EB Right	B	20	C	22
Kapolei WB Left	C	32	C	26
Kapolei WB Through	C	24	C	20
Kapolei WB Right	C	21	B	18
Kinoiki NB Left	D	35	C	28
Kinoiki NB Through	C	26	C	28
Kinoiki NB Right	C	26	C	28
Kinoiki SB Left	C	28	C	28
Kinoiki SB Through	B	18	C	26
Kinoiki SB Right	B	19	C	26
Kapolei Pkwy & Kualakai Pkwy	**B**	**18**	**B**	**19**
Kapolei EB Left	B	20	C	22
Kapolei EB Through	A	5	A	7
Kapolei WB Through	B	18	C	21
Kapolei WB Right	B	18	C	22
Kualakai SB Left	C	22	C	21
Kualakai SB Right	C	21	B	19

Delay is expressed in seconds per vehicle

Table 4 Projected 2013 LOS With Project (cont.)

Total 2013 with Phase 1	AM		PM	
	LOS	Delay	LOS	Delay
Kapolei Pkwy & Renton Rd	**C**	**24**	**B**	**18**
Kapolei EB Left	C	34	C	25
Kapolei EB Through-Right	B	16	B	12
Kapolei WB Left	D	38	C	35
Kapolei WB Through-Right	C	24	B	18
Renton NB Left	B	20	B	18
Renton NB Through-Right	C	21	C	21
Renton SB Left	C	31	C	24
Renton SB Through	C	21	B	19
Renton SB Right	C	21	B	18
Roosevelt Ave & West Entrance	**Unsignalized**		**Unsignalized**	
Roosevelt EB Left	A	9	A	9
West Entrance SB Left	C	20	E	42
West Entrance SB Right	B	14	B	12

Delay is expressed in seconds per vehicle

3. Kapolei Parkway/Kualakai Parkway

The intersection of Kapolei Parkway and Kualakai Parkway is projected to operate at LOS B during both peak hours. All individual movements are projected to operate at LOS C during both the AM and PM peak hours.

4. Kapolei Parkway/Renton Road

The intersection of Kapolei Parkway and Renton Road is projected to operate at LOS C during the AM peak hour. Left turn movements are projected to operate at LOS D or better. During the PM peak hour, the intersection is projected to operate at LOS B overall with all movements operating at LOS D.

5. Roosevelt Avenue/West Entrance

The west Ka Makana Alii access is projected to be stop-controlled with a refuge lane on Roosevelt Avenue. The southbound left turn out is projected to operate at LOS C during the AM peak hour and at LOS E during the PM peak hour.

C. Transit

Honolulu High-Capacity Transit Corridor Project (HHCTCP) has started its first phase of construction connecting East Kapolei to Pearl Highlands via Waipahu. The Phase 1 segment is expected to be operational in 2013. The western terminus of the first phase of the transit alignment is located at East Kapolei Station near the Kroc Center. The existing bus services will be rerouted to serve East Kapolei Station and Ka Makana Alii.

D. Summary of 2013 Operations With Phase 1

Overall the Ka Makana Alii shopping center has the greatest impact on the Kapolei Parkway/Kinoiki Street intersection. This is understandable because the intersection would be improved from a tee intersection to a four-legged intersection, one approach of which would be the shopping center's primary access. The center also increases the delay at the Kapolei Parkway/North-South Road intersection but the LOS is unchanged. All other study area intersections are projected to operate acceptably.

V. PROJECTED 2015 CONDITIONS WITHOUT PROJECT

The base year 2015 represents future conditions within the project area without the Ka Makana Alii shopping center. No new roadways are projected to be constructed in the vicinity of the project.

A. Projected 2015 Network Without Project

The 2015 roadway network is assumed to be the same as the 2013 roadway network. Configurations at the study area intersections and roads are expected to be the same in both the 2013 and 2015 scenarios.

B. Projected 2015 Traffic Without Project

The 2015 background traffic was estimated using data for the following developments:

- East Kapolei I – Phase 2
- East Kapolei II
- University of Hawaii – West Oahu
- Kroc Center

With Kapolei Parkway and Kualakai Parkway in place, traffic volumes were shifted from Farrington Highway and Roosevelt Avenue. Furthermore, annual growth was applied. Finally, trips associated with the East Kapolei Phase I and Kroc Center developments were generated using trip generation equations published by the Institute of Transportation Engineers in Trip Generation, Eighth Edition.

The projected 2015 traffic turning movement volumes without project are shown in Figure 10.

C. Projected 2015 Operations Without Project

The projected 2015 intersection level of service without the Ka Makana Alii shopping center are shown in Table 5.

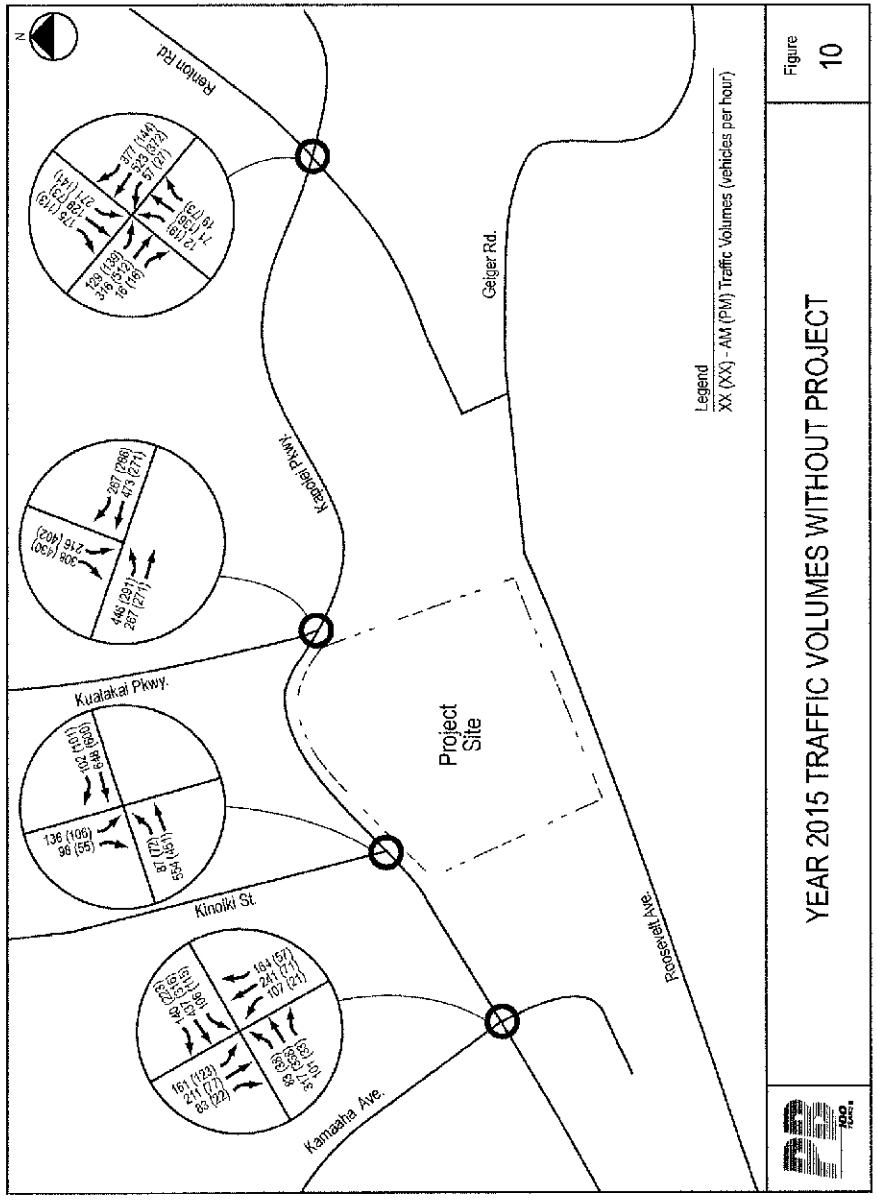


Table 5 Projected 2015 LOS Without Project

2015 background without NSR Extension	AM		PM	
	LOS	Delay	LOS	Delay
Kapolei Pkwy & Kamaaha Ave	**C**	**35**	**C**	**23**
Kapolei EB Left	D	49	C	33
Kapolei EB Through-Right	D	38	C	24
Kapolei WB Left	D	44	C	28
Kapolei WB Through-Right	D	36	B	19
Kamaaha NB Left	C	27	C	26
Kamaaha NB Through-Right	D	37	C	28
Kamaaha SB Left	D	44	C	28
Kamaaha SB Through-Right	B	14	B	14
Kapolei Pkwy & Kinoiki St	**B**	**12**	**B**	**12**
Kapolei EB Left	C	22	C	21
Kapolei EB Through	A	6	A	6
Kapolei WB Through	B	15	B	14
Kapolei WB Right	B	13	B	12
Kinoiki SB Left	B	19	B	17
Kinoiki SB Right	B	17	B	16
Kapolei Pkwy & Kualakai Pkwy	**B**	**17**	**B**	**17**
Kapolei EB Left	B	20	C	21
Kapolei EB Through	A	5	A	7
Kapolei WB Through	B	18	B	19
Kapolei WB Right	B	18	B	20
Kualakai SB Left	C	22	B	19
Kualakai SB Right	C	20	B	17
Kapolei Pkwy & Renton Rd	**C**	**25**	**B**	**18**
Kapolei EB Left	D	35	C	24
Kapolei EB Through-Right	B	17	B	12
Kapolei WB Left	D	40	C	34
Kapolei WB Through-Right	C	24	B	18
Renton NB Left	C	20	B	18
Renton NB Through-Right	C	21	C	20
Renton SB Left	C	32	C	23
Renton SB Through	C	22	B	18
Renton SB Right	C	21	B	18

Delay is expressed in seconds per vehicle

1. Kapolei Parkway/Kamaaha Avenue

The intersection of Kapolei Parkway and Kamaaha Avenue is projected to operate at LOS C during the AM peak. All movements are projected to operate at LOS D or better. During the PM peak hour, the intersection is projected to operate at LOS C overall as well. All individual movements are projected to operate at LOS C or better.

2. Kapolei Parkway/Kinoiki Street

The existing intersection of Kapolei Parkway and Kinoiki Street is an unsignalized tee-intersection. In order to provide an accurate comparison between the with and without-project scenarios, it was analyzed as a signalized intersection in both cases. The intersection is projected to operate at LOS B during both the AM and PM peak hours.

3. Kapolei Parkway/Kualakai Parkway Street

The intersection of Kapolei Parkway and Kualakai Parkway is projected to operate at LOS B during both peak hours. All individual movements are projected to operate at LOS C during the AM peak hour and at LOS B or better during the PM peak hour.

4. Kapolei Parkway/Renton Road

The intersection of Kapolei Parkway and Renton Road is projected to operate at LOS C during the AM peak hour. Left turn movements are projected to operate at LOS D or better. During the PM peak hour, the intersection is projected to operate at LOS B overall with all movements operating at LOS C.

D. Summary of 2015 Operations Without Project

The study area intersections are projected to operate at an acceptable level during the AM and PM peak hours. All study area intersections are projected to operate at LOS B or C overall during the AM and PM peak hours.

VI. PROJECTED 2015 CONDITIONS WITH PHASE 2

The 2015 "With Project" scenario represents the future conditions within the project area with Phase 2 of the Ka Makana Alii shopping center development, shown in Figure 3. As shown, a fourth leg would be constructed at the intersection of Kapolei Parkway and Kualakai Parkway which would access the site. This would be Ka Makana Alii's new main access, deemphasizing the access at Kinoiki Street. This new leg would terminate at the shopping center's driveway. The access to Roosevelt Avenue from Phase 1 would remain but would be deemphasized in favor of an additional eastern Roosevelt Avenue access constructed during Phase 2.

Additional right-in/right-out service accesses are also planned to be added in Phase 2. One is planned to be located on Kapolei Parkway midway between Kinoiki Street and Kualakai Parkway. The other is planned to be located on Kualakai Parkway just south of Kapolei Parkway. While the additional accesses are primarily intended to be service accesses, they would also provide an additional driveway to alleviate pressure on other accesses.

A. Project-Related Traffic Volumes

Future traffic generated by the Ka Makana Alii shopping center was estimated.

1. Trip Generation

Ka Makana Alii consists of four uses that can be classified as shopping center, office building, hotel, and cinema. Trip generation estimates the number of vehicular trips in and out of the project based on the land use type and density. Trips were estimated using trip generation equations published by the Institute of Transportation Engineers in Trip Generation, Eighth Edition.

Table 6 shows the planned project land use and corresponding trips generated. Pass-by traffic was assumed to be 20% during the PM while transit share was assumed to be 7%.

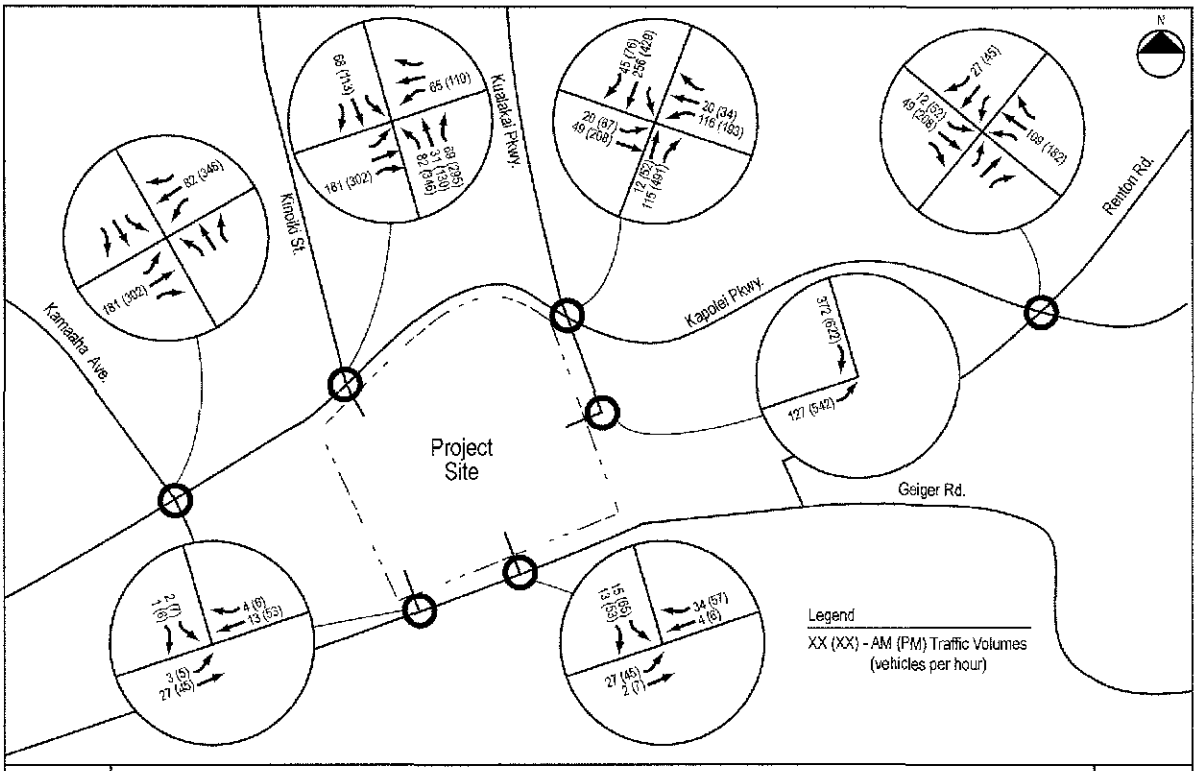
Table 6 Ka Makana Alii Phase 2 Trip Generation

		AM Peak Hour			PM Peak Hour		
		In	Out	Total	In	Out	Total
	OFFICE						
710	General Office Building	307	42	349	55	267	322
	Mode Reductions	25	3	28	4	21	25
	After Mode Reductions	282	39	321	51	246	297
	RETAIL						
820	Shopping Center	342	218	560	1,350	1,406	2,756
	Mode Reductions	27	17	44	108	112	220
	Pass-by Traffic Reductions	0	0	0	270	281	551
	After Mode Reductions	342	218	560	1,080	1,125	2,205
	HOTEL						
310	Hotel	171	109	280	156	139	295
	Mode Reductions	14	9	23	12	11	23
	After Mode Reductions	157	100	257	144	128	272
	CINEMA/ENTERTAINMENT						
445	Multiplex Movie Theater	0	0	0	101	62	163
	Mode Reductions	0	0	0	8	5	13
	After Mode Reductions	0	0	0	93	57	150
	Subtotal Trips (Before Mode Reductions)	820	369	1,189	1,662	1,874	3,536
	Total Mode Reductions	66	29	95	402	430	832
	Total External Trips	**754**	**340**	**1,094**	**1,260**	**1,444**	**2,704**

Volumes expressed in vehicles per hour

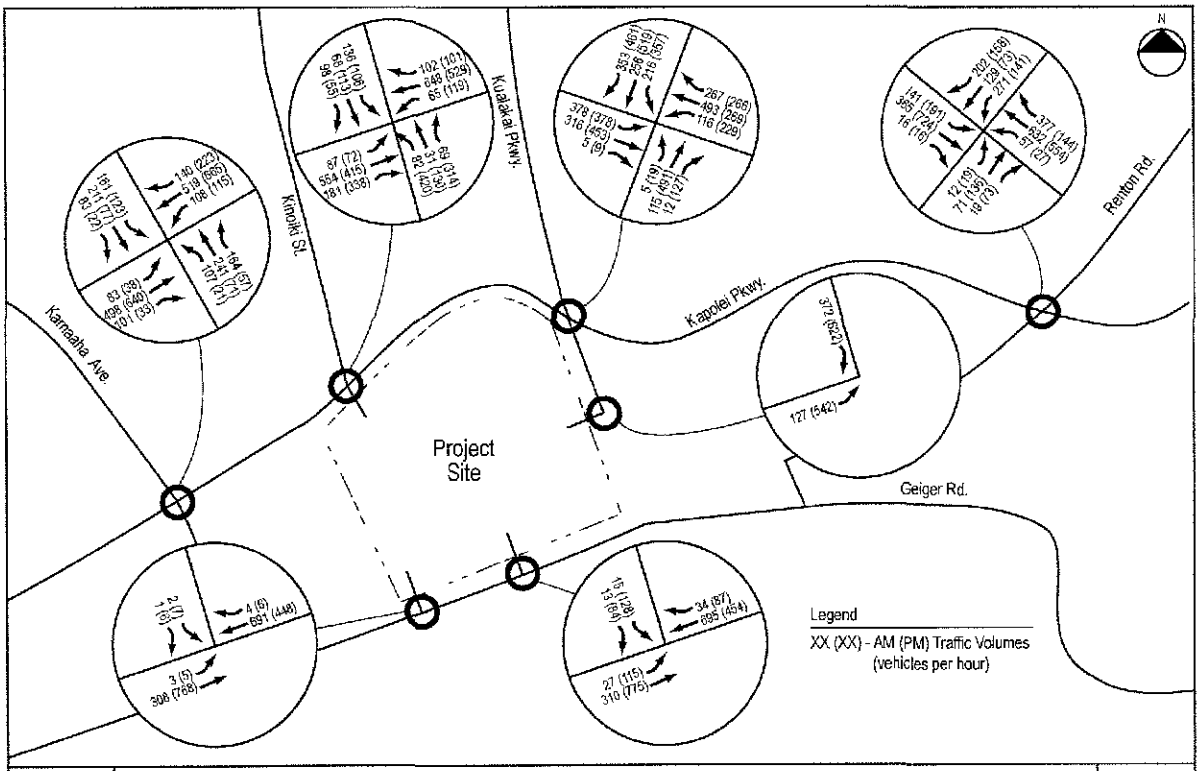
2. Trip Assignment

The shopping center distribution was calculated according to the Oahu Metropolitan Planning Organization model. The project-generated traffic volumes were assigned to the future network based using this trip distribution. The project-generated trips are shown in Figure 11. The projected 2015 traffic volumes with Phase 2 are shown in Figure 12.



PHASE 2 PROJECT-RELATED TRAFFIC VOLUMES

Figure 11



YEAR 2015 TOTAL TRAFFIC VOLUMES WITH PROJECT PHASE 2

Figure 12

B. Projected 2015 Operations With Phase 2

The projected 2015 intersection level of service with Phase 1 of the Ka Makana Alii shopping center are shown in Table 7.

Table 7 Projected 2015 LOS With Project

Total 2015 with Phase 2	AM		PM	
	LOS	Delay	LOS	Delay
Kapolei Pkwy & Kamaaha Ave	**D**	**36**	**C**	**24**
Kapolei EB Left	D	51	D	39
Kapolei EB Through-Right	D	39	C	25
Kapolei WB Left	D	46	C	33
Kapolei WB Through-Right	D	36	B	20
Kamaaha NB Left	C	29	C	30
Kamaaha NB Through-Right	D	41	C	33
Kamaaha SB Left	D	47	C	33
Kamaaha SB Through-Right	B	16	B	18
Kapolei Pkwy & Kinoiki St	**C**	**24**	**C**	**28**
Kapolei EB Left	C	32	D	36
Kapolei EB Through	C	21	C	26
Kapolei EB Right	B	19	C	25
Kapolei WB Left	C	32	C	34
Kapolei WB Through	C	23	C	26
Kapolei WB Right	C	20	C	23
Kinoiki NB Left	C	32	C	31
Kinoiki NB Through	C	29	C	28
Kinoiki NB Right	C	28	C	26
Kinoiki SB Left	C	28	C	33
Kinoiki SB Through	C	24	C	33
Kinoiki SB Right	C	23	C	30

Delay is expressed in seconds per vehicle

Table 7 Projected 2015 LOS With Project (cont.)

Total 2015 with Phase 2 (continued)	AM		PM	
	LOS	Delay	LOS	Delay
Kapolei Pkwy & Kualakai Pkwy	**C**	**27**	**D**	**37**
Kapolei EB Left	C	31	D	47
Kapolei EB Through-Right	B	20	D	39
Kapolei WB Left	C	34	D	49
Kapolei WB Through	C	29	D	42
Kapolei WB Right	C	29	D	47
Kualakai SB Left	C	33	D	48
Kualakai SB Through	B	20	C	22
Kualakai SB Right	B	19	B	20
Kualakai NB Left	A	0	E	61
Kualakai NB Through-Right	C	34	D	36
Kapolei Pkwy & Renton Rd	**C**	**26**	**B**	**20**
Kapolei EB Left	D	40	C	29
Kapolei EB Through-Right	B	17	B	12
Kapolei WB Left	D	44	D	42
Kapolei WB Through-Right	C	26	C	21
Renton NB Left	C	22	C	21
Renton NB Through-Right	C	24	C	25
Renton SB Left	D	35	C	30
Renton SB Through	C	24	C	22
Renton SB Right	C	23	C	22
Roosevelt Ave & West Entrance	**Unsignalized**		**Unsignalized**	
Roosevelt EB Left	A	9	A	8
West Entrance SB Left	C	20	D	27
West Entrance SB Right	B	14	B	11
Roosevelt Ave & East Entrance	**B**	**12**	**B**	**15**
Roosevelt EB Left	C	31	C	26
Roosevelt EB Through	A	4	A	9
Roosevelt WB Left	B	15	B	19
Roosevelt WB Right	A	7	B	13
East Entrance SB Left	C	22	C	26
East Entrance SB Right	C	22	C	23

Delay is expressed in seconds per vehicle

1. Kapolei Parkway/Kamaaha Avenue

The intersection of Kapolei Parkway and Kamaaha Avenue is projected to operate at LOS D overall during the AM peak. All movements operate at LOS D or better. During the PM peak hour, the intersection is projected to operate at LOS C overall. All individual movements are projected to operate at LOS D or better.

2. Kapolei Parkway/Kinoiki Street

With the opening of the new access to Kualakai Parkway as part of Phase 2, the Kinoiki Street access will be deemphasized. The intersection is projected to operate at LOS C during both the AM and PM peak hours. During the AM peak hour, all movements are expected to operate at LOS C or better. During the PM peak hour, all movements are projected to operate at LOS C or better with the exception of the eastbound Kapolei Parkway left.

3. Kapolei Parkway/Kualakai Parkway

The intersection of Kapolei Parkway and Kualakai Parkway is projected to operate at LOS C during the AM peak hour. All movements are projected to operate at LOS C or better. During the PM peak hour, the intersection is projected to operate at LOS D overall. The northbound left from the shopping center is projected to operate at LOS E but all other movements are projected to operate at LOS D or better.

4. Kapolei Parkway/Renton Road

The intersection of Kapolei Parkway and Renton Road is projected to operate at LOS C during the AM peak hour. All movements are projected to operate at LOS D or better. During the PM peak hour, the intersection is projected to operate at LOS B overall with all movements operating at LOS C or better with the exception of the westbound Kapolei Parkway left which is projected to operate at LOS D.

5. Roosevelt Avenue/West Entrance

The west Ka Makana Alii access is projected to be stop-controlled with a refuge lane on Roosevelt Avenue. The southbound left turn out is projected to operate at LOS C during the AM peak hour and at LOS D during the PM peak hour.

6. Roosevelt Avenue/East Entrance

The east Ka Makana Alii access is projected to be signalized tee-intersection with Roosevelt Avenue. The intersection is projected to operate at LOS B for the AM and PM peak hours, with all movements operating at LOS C or better.

C. Transit

By Year 2015, HHCTCP will further extend the alignment to Aloha Stadium. The transit ridership will increase significantly from 2013. The bus routes serving Ka Makana Alii include Route 41 connecting Ewa Beach, UHWO, and Kapolei City; Route 411 connecting Makakilo, Kapolei City, and East Kapolei; Route 416 connecting Kapolei City and East Kapolei; Route 418 connecting Kapolei City, Kalaeloa, and East Kapolei; Route 421 connecting West Loch, Hoopili, UHWO, and East Kapolei; Route 422 connecting Hoopili and East Kapolei,

D. Summary of 2015 Operations With Phase 2

With the extension of Kualakai Parkway beyond Kapolei Parkway, the Kinoiki Street intersection is expected to process less project-related traffic. Ka Makana Alii would have the greatest impact on the Kapolei Parkway/Kualakai Parkway intersection. All other study area intersections are projected to operate acceptably.

VII. CONCLUSION AND RECOMMENDATIONS

A. Conclusion

It is concluded that while delays experienced along Kapolei Parkway are expected to increase, the intersections are still projected to operate at an acceptable level during the AM and PM commuter peak hours. The Ka Makana Alii shopping center traffic can be accommodated by the adjacent roadway network.

B. Recommendations

Based on the operational analyses of intersections, the following are recommended to be implemented in conjunction with the proposed shopping center:

Phase 1 Recommendations

- Signalize the north Ka Makana Alii access to Kapolei Parkway at the intersection with Kinoiki Street.
- Configure the intersection of Kapolei Parkway and Kinoiki Street as follows:
    - Eastbound Kapolei Parkway approach as a left turn lane, 3 through lanes, and a right turn lane;
    - Westbound Kapolei Parkway approach as 2 left turn lanes, 3 through lanes, and a right turn lane;
    - Northbound Ka Makana Alii driveway approach as 2 left turn lanes, a through lane, and a right turn lane;
    - Southbound Kinoiki Street approach as a left turn lane, a through lane, and a right turn lane.
- Configure the west Roosevelt Avenue driveway's intersection with Roosevelt Avenue as stop-controlled at the driveway approach. An eastbound left turn and a westbound right turn lane from Roosevelt Avenue into the shopping center are desirable. A refuge lane for southbound left turns exiting the shopping center is also desirable.

- Provide a right-in/right-out driveway at the western edge of the property along Kapolei Parkway.

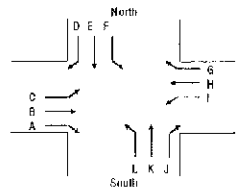
Phase 2 Recommendations

- Configure the intersection of Kapolei Parkway and Kualakai Parkway as follows:
    - Eastbound Kapolei Parkway approach as 2 left turn lanes, 2 through lanes, and a shared through/right turn lane;
    - Westbound Kapolei Parkway approach as 2 left turn lanes, 3 through lanes, and 2 right turn lanes;
    - Northbound Kualakai Parkway approach as a left turn lane, a through lane, and a shared through/right turn lane;
    - Southbound Kualakai Parkway approach as 2 left turn lanes, 2 through lanes, and 2 right turn lanes.
- Install a traffic signal at the east Roosevelt Avenue driveway's intersection with Roosevelt Avenue. An eastbound left turn lane into the shopping center and right turn lane from Roosevelt Avenue into the shopping center are desirable.
- Coordinate with theBus to provide frequent regional and sub-regional bus services connecting major activity centers in the area such as Kapolei City, Makakilo, Waipahu, UHWO, and Ewa as well as with the transit stations in Waipahu and Kapolei.
- Provide right-in/right-out driveways on Kualakai Parkway south of Kapolei Parkway and on Kapolei Parkway between Kinoiki Street and Kualakai Parkway. These driveways will alleviate some of the traffic load at the main accesses.

Appendix A
Existing Traffic Data

AM COUNT SHEET

Intersection: Kapolei Pkwy/Kamaaina Ave
Date: Tuesday 3/30/2010
By: Jonathan
Weather: Windy/Drizzly

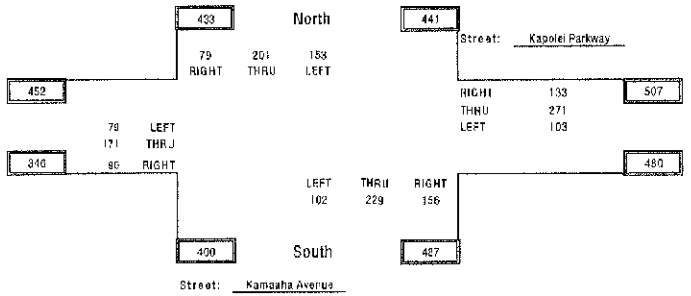


Street: Kapolei Parkway

Street: Kamaaha Avenue

TIME	A	B	C	D	E	F	G	H	I	J	K	L	Total Mvmt	Total Hour
6:30 AM - 6:45 AM	3	33	0	3	7	46	23	32	6	43	11	2	201	1175
6:45 AM - 7:00 AM	9	25	2	7	14	44	28	21	14	39	14	5	222	1548
7:00 AM - 7:15 AM	20	23	7	3	21	40	25	46	22	51	33	16	310	1773
7:15 AM - 7:30 AM	27	45	13	14	58	34	26	58	28	40	09	20	442	1631
7:30 AM - 7:45 AM	24	61	25	41	71	34	41	100	34	24	60	39	574	1335
7:45 AM - 8:00 AM	25	42	34	21	41	15	36	67	19	41	47	27	447	
8:00 AM - 8:15 AM	6	24	6	1	4	23	32	34	11	15	11	1	168	
8:15 AM - 8:30 AM	4	22	7	4	5	22	22	31	6	18	2	1	146	
Phf	0.689	0.701	0.581	0.482	0.708	0.850	0.911	0.678	0.757	0.765	0.716	0.654	Peak	Phf
7:00 AM - 8:00 AM	96	171	79	79	201	153	133	271	103	156	229	102	1773	0.772

Peak Hour
7:00 AM - 8:00 AM



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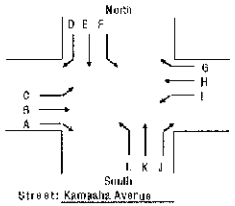
AM COUNT SHEET

Intersection: Kapolei Pkwy/Kamaaha Ave
Date: Tuesday 3/30/2010
By: Jonathan
Weather: Windy/Drizzly



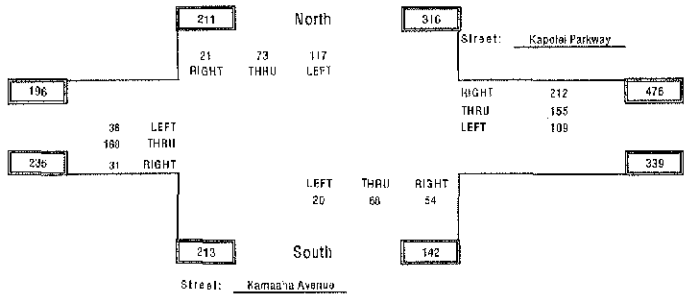
Street: Kapolei Parkway

Street: Kamaaha Avenue

TIME	A	B	C	D	E	F	G	H	I	J	K	L	Total Mvmt	Total Hour
3:30 PM - 3:45 PM	9	43	10	7	21	44	57	42	30	13	22	7	308	1064
3:45 PM - 4:00 PM	6	29	8	4	18	27	59	26	22	17	16	3	235	981
4:00 PM - 4:15 PM	6	52	8	7	17	29	39	44	28	15	14	5	264	972
4:15 PM - 4:30 PM	10	44	10	3	17	17	57	43	26	9	16	5	257	918
4:30 PM - 4:45 PM	9	47	2	7	16	24	44	26	28	0	10	5	225	897
4:45 PM - 5:00 PM	5	29	11	9	14	23	51	45	21	8	8	2	225	
5:00 PM - 5:15 PM	3	34	6	5	11	22	38	30	26	12	14	1	210	
5:15 PM - 5:30 PM	6	37	14	7	15	31	42	35	24	9	12	4	236	
Phf	0.775	0.868	0.900	0.750	0.869	0.885	0.898	0.881	0.836	0.794	0.773	0.714	Peak	Phf
3:30 PM - 4:30 PM	31	168	36	21	73	117	212	155	109	54	68	20	1064	0.864

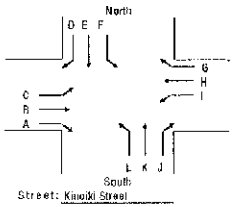
Peak Hour

3:30 PM - 4:30 PM



AM COUNT SHEET

Intersection: Kapolei Pkwy/Kinoiki St
Date: Tuesday 3/30/2010
By: Herbert
Weather: Windy, Drizzly



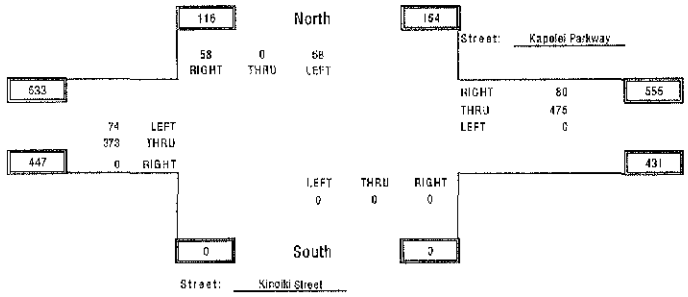
Street: Kapolei Parkway

Street: Kinoiki Street

TIME	A	B	C	D	E	F	G	H	I	J	K	L	Total Mvmt	Total Hour
6:30 AM - 6:45 AM	0	97	17	4	0	18	37	44	0	0	0	0	212	920
6:45 AM - 7:00 AM	0	84	6	4	0	16	18	60	0	0	0	0	188	1026
7:00 AM - 7:15 AM	0	89	19	8	0	19	20	90	0	0	0	0	249	1118
7:15 AM - 7:30 AM	0	97	9	15	0	14	18	118	0	0	0	0	271	1000
7:30 AM - 7:45 AM	0	88	21	21	0	11	20	157	0	0	0	0	318	883
7:45 AM - 8:00 AM	0	95	25	14	0	14	22	110	0	0	0	0	280	
8:00 AM - 8:15 AM	0	48	7	6	0	12	15	43	0	0	0	0	131	
8:15 AM - 8:30 AM	0	58	5	5	0	10	11	65	0	0	0	0	154	
Phf	#DIV/0!	0.961	0.740	0.690	#DIV/0!	0.783	0.909	0.756	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	Peak	Phf
7:00 AM - 8:00 AM	0	373	74	58	0	58	80	475	0	0	0	0	1118	0.879

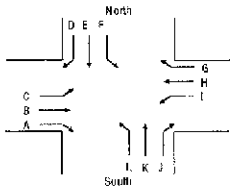
Peak Hour

7:00 AM - 8:00 AM



AM COUNT SHEET

Intersection: Kapolei Pkwy/Kinoiki St
Date: Tuesday 3/30/2010
By: Herbart
Weather: Windy, Drizzly



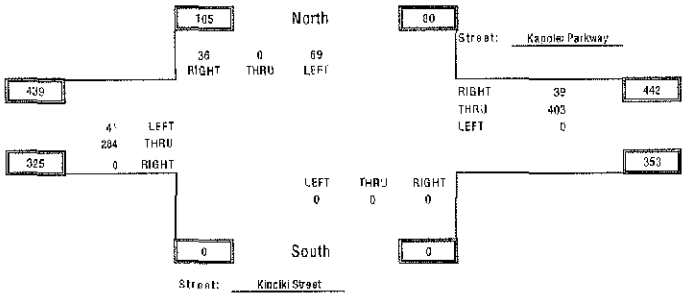
Street: Kapolei Parkway

Street: Kinoiki Street

TIME	A	B	C	D	E	F	G	H	I	J	K	L	Total Mvmt	Total Hour
3:30 PM - 3:45 PM	0	90	11	13	0	37	8	110	0	0	0	0	269	872
3:45 PM - 4:00 PM	0	60	8	10	0	13	14	99	0	0	0	0	204	810
4:00 PM - 4:15 PM	0	68	15	5	0	11	8	96	0	0	0	0	203	809
4:15 PM - 4:30 PM	0	66	7	8	0	8	9	98	0	0	0	0	196	796
4:30 PM - 4:45 PM	0	73	6	6	0	19	11	98	0	0	0	0	213	892
4:45 PM - 5:00 PM	0	54	3	5	0	15	12	108	0	0	0	0	197	
5:00 PM - 5:15 PM	0	63	8	12	0	13	9	87	0	0	0	0	192	
5:15 PM - 5:30 PM	0	72	6	11	0	9	10	92	0	0	0	0	200	
Phf	#DIV/0!	0.789	0.683	0.692	#DIV/0!	0.486	0.696	0.916	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	Peak	Phf
3:30 PM - 4:30 PM	0	284	41	36	0	69	39	403	0	0	0	0	872	0.810

Peak Hour

3:30 PM - 4:30 PM



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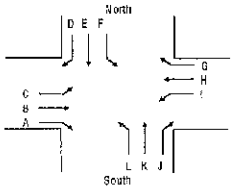
AM COUNT SHEET

Intersection: Kapolei Pkwy/Kualakai Pkwy
Date: Tuesday 3/30/2010
By: Shenghong
Weather: Windy/Drizzly



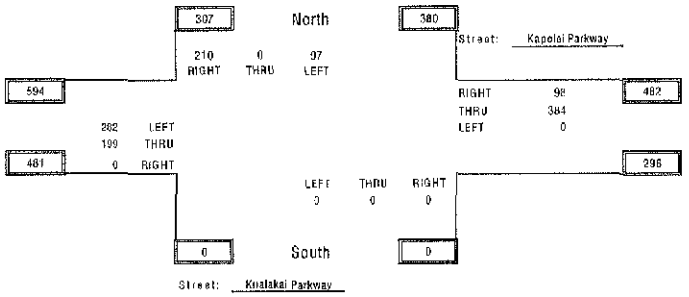
Street: Kapolei Parkway

Street: Kualakai Parkway

TIME	A	B	C	D	E	F	G	H	I	J	K	L	Total Mvmt	Total Hour
6:30 AM - 6:45 AM		47	77	31		28	30	38					251	1023
6:45 AM - 7:00 AM		34	74	24		17	31	61					241	1186
7:00 AM - 7:15 AM		38	71	37		27	17	79					269	1270
7:15 AM - 7:30 AM		44	78	51		25	27	87					312	1183
7:30 AM - 7:45 AM		65	55	71		22	25	126					364	1332
7:45 AM - 8:00 AM		52	78	51		23	29	92					325	
8:00 AM - 8:15 AM		24	47	32		17	23	39					182	
8:15 AM - 8:30 AM		21	43	32		8	21	35					161	
Phf	#DIV/0!	0.765	0.904	0.739	#DIV/0!	0.698	0.845	0.762	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	Peak	Phf
7:00 AM - 8:00 AM	0	199	282	210	0	97	98	384	0	0	0	0	1270	0.827

Peak Hour

7:00 AM - 8:00 AM



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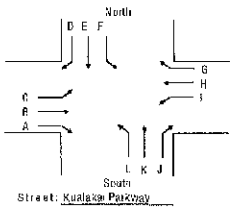
AM COUNT SHEET

Intersection: Kapolei Pkwy/Kualakai Pkwy
Date: Tuesday 3/30/2010
By: Shenghong
Weather: Windy/Drizzly



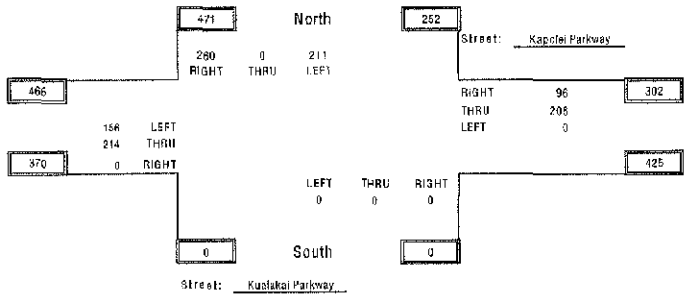
Street: Kapolei Parkway

Street: Kualakai Parkway

TIME	A	B	C	D	E	F	G	H	I	J	K	L	Total Mvmt	Total Hour
3:30 PM - 3:45 PM		70	64	53		43	37	65					332	1143
3:45 PM - 4:00 PM		38	35	70		54	22	42					261	1079
4:00 PM - 4:15 PM		53	32	71		57	19	40					272	1088
4:15 PM - 4:30 PM		53	25	66		57	18	59					278	1067
4:30 PM - 4:45 PM		49	48	66		60	14	33					268	1079
4:45 PM - 5:00 PM		49	29	81		58	15	48					280	
5:00 PM - 5:15 PM		40	23	58		56	15	41					241	
5:15 PM - 5:30 PM		59	32	62		71	18	46					290	
Phf	#DIV/0!	0.764	0.609	0.915	#DIV/0!	0.925	0.649	0.792	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	Peak	Phf
3:30 PM - 4:30 PM	0	214	158	260	0	211	96	206	0	0	0	0	1143	0.861

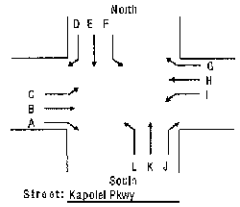
Peak Hour

3:30 PM - 4:30 PM



AM COUNT SHEET

Intersection: Kapolei Pkwy/Renton Rd
Date: Tuesday 3/30/2010
By: fiusa
Weather: Windy/Drizzly



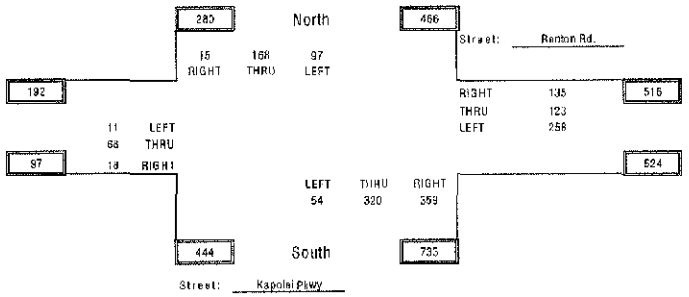
Street: Renton Rd.

Street: Kapolei Pkwy

TIME	A	B	C	D	E	F	G	H	I	J	K	L	Total Mvmt	Total Hour
6:30 AM - 6:45 AM														
6:45 AM - 7:00 AM	5	9	4	4	35	10	25	25	28	44	58	7	254	1477
7:00 AM - 7:15 AM	2	11	2	6	38	14	23	25	30	64	76	17	310	1626
7:15 AM - 7:30 AM	4	24	1	0	47	26	29	29	50	90	86	13	401	1509
7:30 AM - 7:45 AM	3	14	4	5	41	31	49	37	104	124	86	14	512	1269
7:45 AM - 8:00 AM	9	19	1	2	42	26	34	32	74	81	70	10	403	
8:00 AM - 8:15 AM	6	18	2	4	24	13	20	15	16	24	45	6	193	
8:15 AM - 8:30 AM	9	5	7	2	23	5	24	11	9	28	32	8	161	
Phf	0.500	0.708	0.688	0.469	0.894	0.782	0.689	0.831	0.820	0.724	0.909	0.794	Peak	Phf
7:00 AM - 8:00 AM	18	68	11	15	168	97	135	123	256	359	320	54	1626	0.794

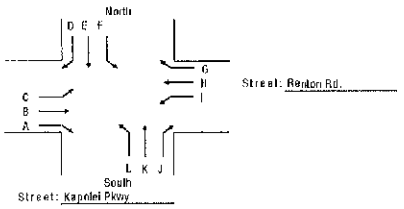
Peak Hour

7:00 AM - 8:00 AM



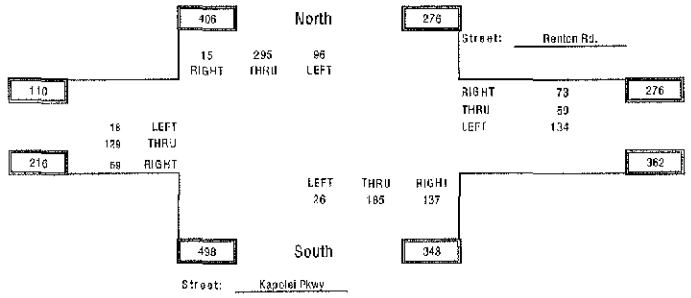
AM COUNT SHEET

Intersection: Kapolei Pkwy/Renton Rd
Date: Tuesday 3/30/2010
By: Russ
Weather: Windy/Drizzly



TIME	A	B	C	D	E	F	G	H	I	J	K	L	Total Mvmt	Total Hour
3:30 PM - 3:45 PM	12	28	9	0	66	21	19	18	25	39	61	7	325	1246
3:45 PM - 4:00 PM	18	29	5	8	61	26	14	24	32	27	35	4	283	1235
4:00 PM - 4:15 PM	16	42	1	3	77	20	23	9	37	28	42	9	307	1237
4:15 PM - 4:30 PM	23	30	3	4	71	29	17	16	40	43	47	6	331	1219
4:30 PM - 4:45 PM	22	25	6	6	84	22	16	22	36	34	35	6	314	1189
4:45 PM - 5:00 PM	10	21	4	8	81	11	20	21	34	31	35	9	285	
5:00 PM - 5:15 PM	18	24	4	10	83	12	16	13	30	26	43	10	289	
5:15 PM - 5:30 PM	13	25	1	1	96	19	15	18	33	31	38	11	301	
Phf	0.750	0.768	0.500	0.469	0.858	0.828	0.793	0.719	0.838	0.797	0.768	0.722	Peak	Phf
3:30 PM - 4:30 PM	69	129	18	15	295	96	73	69	134	137	165	26	1246	0.941

Peak Hour
3:30 PM - 4:30 PM



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Appendix B
Level of Service Definitions

The Highway Capacity Manual defines six Level of Service (LOS), labeled A through F, from best to worst conditions. Level of Service for signalized and unsignalized intersections are defined in terms of average user delays. Delay is a measure of driver discomfort, frustration, fuel consumption, and lost travel time.

For unsignalized intersections, the Highway Capacity Manual evaluates gaps in the major street traffic flow and calculates available gaps for left-turns across oncoming traffic and for the left and right-turns onto the major roadway from the minor street.

LEVEL-OF-SERVICE A: Little or no delay.

LEVEL-OF-SERVICE B: Short traffic delays.

LEVEL-OF-SERVICE C: Average traffic delays.

LEVEL-OF-SERVICE D: Long traffic delays.

LEVEL-OF-SERVICE E: Very long traffic delays.

LEVEL-OF-SERVICE F: Demand volume exceeds capacity, resulting in extreme delays with queuing that may cause severe congestion and affect other movements at the intersection.

Appendix C

Intersection Capacity Analysis Worksheets

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	79	171	96	103	271	133	102	229	156	153	201	79
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0		6.0	6.0		5.0	5.0		5.0	5.0	
Lane Util. Factor	1.00	0.91		1.00	0.91		1.00	1.00		1.00	1.00	
Frt	1.00	0.95		1.00	0.95		1.00	0.94		1.00	0.96	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	4812		1770	4834		1770	1749		1770	1784	
Flt Permitted	0.95	1.00		0.95	1.00		0.57	1.00		0.95	1.00	
Satd. Flow (perm)	1770	4812		1770	4834		1071	1749		1770	1784	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	86	186	104	112	295	145	111	249	170	166	218	86
RTOR Reduction (vph)	0	83	0	0	70	0	0	15	0	0	8	0
Lane Group Flow (vph)	86	207	0	112	370	0	111	404	0	166	296	0
Turn Type	Prot			Prot			Perm			Prot		
Protected Phases	7	4		3	8			2		1	6	
Permitted Phases							2					
Actuated Green, G (s)	8.6	13.6		11.7	16.7		29.2	29.2		14.8	49.0	
Effective Green, g (s)	8.6	13.6		11.7	16.7		29.2	29.2		14.8	49.0	
Actuated g/C Ratio	0.09	0.15		0.13	0.18		0.32	0.32		0.16	0.54	
Clearance Time (s)	6.0	6.0		6.0	6.0		5.0	5.0		5.0	5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	167	717		227	884		343	559		287	957	
v/s Ratio Prot	0.05	0.04		c0.06	c0.08			c0.23		c0.09	0.17	
v/s Ratio Perm							0.10					
v/c Ratio	0.51	0.29		0.49	0.42		0.32	0.72		0.58	0.31	
Uniform Delay, d1	39.4	34.5		37.0	33.0		23.6	27.5		35.4	11.8	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	2.7	0.2		1.7	0.3		0.6	4.6		2.8	0.2	
Delay (s)	42.0	34.8		38.7	33.3		24.1	32.1		38.2	11.9	
Level of Service	D	C		D	C		C	C		D	B	
Approach Delay (s)		36.4			34.4			30.4			21.2	
Approach LOS		D			C			C			C	

Intersection Summary				
HCM Average Control Delay	30.5	HCM Level of Service	C	
HCM Volume to Capacity ratio	0.61			
Actuated Cycle Length (s)	91.3	Sum of lost time (s)	22.0	
Intersection Capacity Utilization	61.0%	ICU Level of Service	B	
Analysis Period (min)	15			
c Critical Lane Group				

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	74	373	475	80	58	58
Sign Control		Free	Free		Yield	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	80	405	516	87	63	63
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)			1124			
pX, platoon unblocked						
vC, conflicting volume	816				812	172
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	816				812	172
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)						
tF (s)	2.2				3.6	3.3
p0 queue free %	92				78	93
cM capacity (veh/h)	1046				292	842

Direction, Lane #	EB 1	EB 2	EB 3	EB 4	WB 1	WB 2	WB 3	WB 4	SB 1	SB 2
Volume Total	80	135	135	135	172	172	172	87	63	63
Volume Left	80	0	0	0	0	0	0	0	63	0
Volume Right	0	0	0	0	0	0	0	87	0	63
cSH	1046	1700	1700	1700	1700	1700	1700	1700	292	842
Volume to Capacity	0.08	0.08	0.08	0.08	0.10	0.10	0.10	0.05	0.22	0.07
Queue Length 95th (ft)	6	0	0	0	0	0	0	0	20	6
Control Delay (s)	8.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	20.7	9.6
Lane LOS	A								C	A
Approach Delay (s)	1.4				0.0				15.1	
Approach LOS									C	

Intersection Summary				
Average Delay	2.1			
Intersection Capacity Utilization	26.9%	ICU Level of Service	A	
Analysis Period (min)	15			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SWL	SWT	SWR
Lane Configurations												
Volume (vph)	97	160	15	54	320	359	11	88	18	258	123	135
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0		6.0	6.0		5.0	5.0		5.0	5.0	5.0
Lane Util. Factor	1.00	0.91		1.00	0.91		1.00	1.00		1.00	1.00	1.00
Frt	1.00	0.99		1.00	0.92		1.00	0.97		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	5021		1770	4832		1770	1800		1770	1883	1583
Flt Permitted	0.95	1.00		0.95	1.00		0.57	1.00		0.70	1.00	1.00
Satd. Flow (perm)	1770	5021		1770	4832		1250	1800		1297	1883	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	105	183	16	59	348	390	12	74	20	280	134	147
RTOR Reduction (vph)	0	11	0	0	294	0	0	11	0	0	0	99
Lane Group Flow (vph)	105	188	0	59	444	0	12	83	0	280	134	48
Turn Type	Prot			Prot			Perm			Perm		Perm
Protected Phases	7	4		3	8			2			6	
Permitted Phases							2			6		6
Actuated Green, G (s)	6.2	15.2		4.2	13.2		17.5	17.5		17.5	17.5	17.5
Effective Green, g (s)	6.2	15.2		4.2	13.2		17.5	17.5		17.5	17.5	17.5
Actuated g/C Ratio	0.12	0.29		0.08	0.24		0.32	0.32		0.32	0.32	0.32
Clearance Time (s)	6.0	6.0		6.0	6.0		5.0	5.0		5.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0		3.0	3.5		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	204	1417		138	1147		406	585		421	605	514
v/s Ratio Prot	c0.06	0.04		0.03	c0.09			0.05			0.07	
v/s Ratio Perm							0.01			c0.22		0.03
v/c Ratio	0.51	0.13		0.43	0.39		0.03	0.14		0.67	0.22	0.09
Uniform Delay, d1	22.4	14.4		23.7	17.0		12.4	12.9		15.7	13.2	12.7
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	2.2	0.0		2.1	0.2		0.0	0.1		3.9	0.2	0.1
Delay (s)	24.6	14.5		25.8	17.2		12.4	13.0		19.6	13.4	12.8
Level of Service	C	B		C	B		B	B		B	B	B
Approach Delay (s)		18.0			17.8			12.9			16.3	
Approach LOS		B			B			B			B	

Intersection Summary					
HCM Average Control Delay	17.1	HCM Level of Service		B	
HCM Volume to Capacity ratio	0.64				
Actuated Cycle Length (s)	53.9	Sum of lost time (s)		17.0	
Intersection Capacity Utilization	64.8%	ICU Level of Service		A	
Analysis Period (min)	15				
c Critical Lane Group					

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	282	199	384	99	97	210
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0	6.0
Lane Util. Factor	0.97	0.91	0.91	0.88	0.97	0.88
Frt	1.00	1.00	1.00	0.85	1.00	0.85
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	3433	5085	5086	2787	3433	2787
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	3433	5085	5086	2787	3433	2787
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	307	216	417	107	105	228
RTOR Reduction (vph)	0	0	0	0	0	190
Lane Group Flow (vph)	307	216	417	107	105	38
Turn Type	Prot			Over		Perm
Protected Phases	7	4	8	6	6	
Permitted Phases						6
Actuated Green, G (s)	9.9	26.0	10.1	7.6	7.6	7.6
Effective Green, g (s)	9.9	26.0	10.1	7.6	7.6	7.6
Actuated g/C Ratio	0.22	0.57	0.22	0.17	0.17	0.17
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	745	2899	1125	466	572	465
v/s Ratio Prot	c0.09	0.04	c0.08	c0.04	0.03	
v/s Ratio Perm						0.01
v/c Ratio	0.41	0.07	0.37	0.23	0.18	0.08
Uniform Delay, d1	15.3	4.4	16.1	16.6	16.3	16.1
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.4	0.0	0.2	0.3	0.2	0.1
Delay (s)	15.7	4.4	16.3	16.7	16.5	16.1
Level of Service	B	A	B	B	B	B
Approach Delay (s)		11.0	15.5		16.2	
Approach LOS		B	B		B	

Intersection Summary				
HCM Average Control Delay	14.0	HCM Level of Service		B
HCM Volume to Capacity ratio	0.35			
Actuated Cycle Length (s)	45.6	Sum of lost time (s)		18.0
Intersection Capacity Utilization	33.8%	ICU Level of Service		A
Analysis Period (min)	15			
c Critical Lane Group				

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	36	168	31	109	155	212	20	58	54	117	73	21
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0		6.0	6.0		6.0	5.0		6.0	6.0	
Lane Util. Factor	1.00	0.91		1.00	0.91		1.00	1.00		1.00	1.00	
Frt	1.00	0.96		1.00	0.91		1.00	0.93		1.00	0.97	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	4966		1770	4644		1770	1738		1770	1800	
Flt Permitted	0.95	1.00		0.95	1.00		0.69	1.00		0.95	1.00	
Satd. Flow (perm)	1770	4966		1770	4644		1287	1739		1770	1800	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	39	183	34	118	168	230	22	74	59	127	79	23
RTOR Reduction (vph)	0	27	0	0	166	0	0	33	0	0	14	0
Lane Group Flow (vph)	39	190	0	118	230	0	22	100	0	127	88	0
Turn Type	Prot			Prot			Perm			Prot		
Protected Phases	7	4		3	8			2		1	6	
Permitted Phases							2					
Actuated Green, G (s)	2.6	10.9		7.0	16.3		9.4	9.4		7.5	21.9	
Effective Green, g (s)	2.6	10.9		7.0	16.3		9.4	9.4		7.5	21.9	
Actuated g/C Ratio	0.05	0.19		0.12	0.27		0.17	0.17		0.13	0.39	
Clearance Time (s)	6.0	6.0		6.0	6.0		5.0	5.0		6.0	5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	81	963		218	1251		213	288		234	694	
v/s Ratio Prot	0.02	0.04		c0.07	c0.05			c0.06		c0.07	0.05	
v/s Ratio Perm							0.02					
v/c Ratio	0.48	0.20		0.54	0.18		0.10	0.35		0.54	0.13	
Uniform Delay, d1	26.4	16.3		23.4	16.0		20.1	21.0		23.0	11.3	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	4.5	0.1		2.7	0.1		0.2	0.7		2.6	0.1	
Delay (s)	30.9	16.4		26.1	16.0		20.3	21.7		25.6	11.4	
Level of Service	C	B		C	B		C	C		C	B	
Approach Delay (s)		21.1			18.3			21.5			19.3	
Approach LOS		C			B			C			B	

Intersection Summary				
HCM Average Control Delay	19.6	HCM Level of Service		B
HCM Volume to Capacity ratio	0.39			
Actuated Cycle Length (s)	56.8	Sum of lost time (s)		22.0
Intersection Capacity Utilization	42.8%	ICU Level of Service		A
Analysis Period (min)	15			
c Critical Lane Group				

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	41	264	403	36	69	35
Sign Control		Free	Free		Yield	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	45	309	438	42	75	39
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)			1124			
pX, platoon unblocked						
vC, conflicting volume	438				630	166
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	438				630	166
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	95				81	96
cM capacity (veh/h)	1118				397	875

Direction, Lane #	EB 1	EB 2	EB 3	EB 4	WB 1	WB 2	WB 3	WB 4	SB 1	SB 2
Volume Total	45	133	133	133	146	146	146	42	75	39
Volume Left	45	0	0	0	0	0	0	0	75	0
Volume Right	0	0	0	0	0	0	0	42	0	39
cSH	1118	1700	1700	1700	1700	1700	1700	1700	397	875
Volume to Capacity	0.04	0.08	0.08	0.08	0.09	0.09	0.09	0.02	0.19	0.04
Queue Length 95th (ft)	3	0	0	0	0	0	0	0	17	4
Control Delay (s)	8.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	16.2	9.3
Lane LOS	A								C	A
Approach Delay (s)	1.1				0.0				13.9	
Approach LOS									B	

Intersection Summary			
Average Delay	2.1		
Intersection Capacity Utilization	24.8%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SWL	SWT	SWR
Lane Configurations												
Volume (vph)	98	256	15	26	185	137	16	129	69	134	69	73
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	5.0
Lane Util. Factor	1.00	0.91		1.00	0.91		1.00	1.00		1.00	1.00	1.00
Fr	1.00	0.99		1.00	0.94		1.00	0.95		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	5048		1720	4761		1770	1765		1770	1863	1583
Flt Permitted	0.95	1.00		0.95	1.00		0.71	1.00		0.62	1.00	1.00
Satd. Flow (perm)	1770	5048		1720	4761		1319	1765		1162	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	104	321	16	28	201	149	20	140	75	146	75	79
RTOR Reduction (vph)	0	6	0	0	112	0	0	25	0	0	0	66
Lane Group Flow (vph)	104	331	0	28	238	0	20	189	0	146	75	80
Turn Type	Prot			Prot			Perm			Perm		Perm
Protected Phases	7	4		3	8			2			6	
Permitted Phases							2			6		6
Actuated Green, G (s)	8.8	17.1		1.3	11.9		12.0	12.0		12.0	12.0	12.0
Effective Green, g (s)	8.8	17.1		1.3	11.9		12.0	12.0		12.0	12.0	12.0
Actuated g/C Ratio	0.14	0.36		0.03	0.25		0.25	0.25		0.25	0.25	0.25
Clearance Time (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0		4.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	243	1821		49	1186		334	447		294	472	401
v/s Ratio Prot	c0.06	c0.07		0.02	0.05			0.11			0.04	
v/s Ratio Perm							0.02			c0.13		0.01
v/c Ratio	0.43	0.18		0.57	0.20		0.06	0.42		0.50	0.16	0.05
Uniform Delay, d1	18.7	10.4		22.5	14.0		13.4	14.8		16.1	13.8	13.4
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	1.2	0.9		17.8	0.1		0.1	0.6		1.3	0.2	0.1
Delay (s)	20.0	10.4		40.6	14.1		13.5	15.4		16.4	13.9	13.4
Level of Service	B	B		D	B		B	B		B	B	B
Approach Delay (s)		12.7			16.0			15.3			15.0	
Approach LOS		B			B			B			B	

Intersection Summary					
HCM Average Control Delay	14.6	HCM Level of Service		B	
HCM Volume to Capacity ratio	0.37				
Actuated Cycle Length (s)	47.4	Sum of lost time (s)		17.0	
Intersection Capacity Utilization	48.7%	ICU Level of Service		A	
Analysis Period (min)	15				
c Critical Lane Group					

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	156	214	206	96	211	260
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0	6.0
Lane Util. Factor	0.97	0.91	0.91	0.88	0.97	0.88
Frt	1.00	1.00	1.00	0.85	1.00	0.85
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	3433	5085	5085	2787	3433	2787
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	3433	5085	5085	2787	3433	2787
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	170	233	224	104	229	283
RTOR Reduction (vph)	0	0	0	0	0	220
Lane Group Flow (vph)	170	233	224	104	229	63
Turn Type	Prot			Over		Perm
Protected Phases	7	4	8	6	5	
Permitted Phases						5
Actuated Green, G (s)	5.8	19.3	7.5	8.9	8.9	8.9
Effective Green, g (s)	5.8	19.3	7.5	8.9	8.9	8.9
Actuated g/C Ratio	0.14	0.45	0.19	0.22	0.22	0.22
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	495	2441	949	617	760	617
v/s Ratio Prot	c0.05	0.05	c0.04	0.04	c0.07	
v/s Ratio Perm						0.02
v/c Ratio	0.34	0.10	0.24	0.17	0.30	0.10
Uniform Delay, d1	16.5	6.7	13.9	12.7	13.1	12.5
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.4	0.0	0.1	0.1	0.2	0.1
Delay (s)	16.9	6.7	14.0	12.8	13.3	12.5
Level of Service	B	A	B	B	B	B
Approach Delay (s)		10.0	13.8		12.9	
Approach LOS		B	B		B	

Intersection Summary				
HCM Average Control Delay	12.1	HCM Level of Service		B
HCM Volume to Capacity ratio	0.28			
Actuated Cycle Length (s)	40.2	Sum of lost time (s)		18.0
Intersection Capacity Utilization	29.5%	ICU Level of Service		A
Analysis Period (min)	15			
c Critical Lane Group				

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	81	299	99	106	406	137	105	236	161	156	207	81
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Lane Util. Factor	1.00	0.91		1.00	0.91		1.00	1.00		1.00	1.00	
Frt	1.00	0.96		1.00	0.96		1.00	0.94		1.00	0.96	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	4896		1770	4893		1770	1750		1770	1784	
Flt Permitted	0.95	1.00		0.95	1.00		0.57	1.00		0.95	1.00	
Satd. Flow (perm)	1770	4896		1770	4893		1062	1750		1770	1784	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	88	325	108	115	441	149	114	257	175	170	225	88
RTOR Reduction (vph)	0	38	0	0	36	0	0	19	0	0	12	0
Lane Group Flow (vph)	88	395	0	115	552	0	114	413	0	172	301	0
Turn Type	Prot			Prot			Perm			Prot		
Protected Phases	7	4		3	8			2		1	6	
Permitted Phases							2					
Actuated Green, G (s)	8.9	17.5		12.5	21.1		30.7	30.7		15.6	51.5	
Effective Green, g (s)	8.9	17.5		12.5	21.1		30.7	30.7		15.6	51.5	
Actuated g/C Ratio	0.09	0.18		0.13	0.21		0.31	0.31		0.16	0.52	
Clearance Time (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	160	870		226	1048		331	545		284	933	
v/s Ratio Prot	0.05	0.08		c0.06	c0.11			c0.24		c0.10	0.17	
v/s Ratio Perm							0.11					
v/c Ratio	0.55	0.45		0.51	0.53		0.34	0.75		0.61	0.32	
Uniform Delay, d1	42.9	36.2		40.1	34.3		26.1	30.5		38.5	13.5	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	4.0	0.4		2.0	0.6		0.6	6.0		3.6	0.2	
Delay (s)	46.9	36.6		42.1	34.8		26.8	36.5		42.1	13.7	
Level of Service	D	D		D	C		C	D		D	B	
Approach Delay (s)		38.3			36.0			34.5			23.8	
Approach LOS		D			D			C			C	

Intersection Summary				
HCM Average Control Delay	33.6	HCM Level of Service		C
HCM Volume to Capacity ratio	0.66			
Actuated Cycle Length (s)	98.5	Sum of lost time (s)		22.0
Intersection Capacity Utilization	64.7%	ICU Level of Service		C
Analysis Period (min)	15			
c Critical Lane Group				

Movement	EBL	EBT	EBR	WBL	WBT	WBR	SBL	SBR
Lane Configurations								
Volume (vph)	85	515	69	100	155	57		
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900		
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0	6.0		
Lane Util. Factor	1.00	0.91	0.91	1.00	1.00	1.00		
Frt	1.00	1.00	1.00	0.86	1.00	0.85		
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00		
Satd. Flow (prot)	1770	5085	5085	1553	1770	1553		
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00		
Satd. Flow (perm)	1770	5085	5085	1553	1770	1553		
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92		
Adj. Flow (vph)	92	560	69	109	147	105		
RTOR Reduction (vph)	0	0	0	77	0	82		
Lane Group Flow (vph)	92	560	69	32	147	23		
Turn Type	Prot			Perm		Perm		
Protected Phases	7	4	8		1			
Permitted Phases				8		1		
Actuated Green, G (s)	6.8	27.9	55.1	55.1	11.0	11.0		
Effective Green, g (s)	6.8	27.9	55.1	55.1	11.0	11.0		
Actuated g/C Ratio	0.13	0.55	0.39	0.39	0.22	0.22		
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0	6.0		
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0		
Lane Grp Cap (vph)	236	2797	1509	479	383	342		
v/s Ratio Prot	c0.05	0.11	c0.13		c0.08			
v/s Ratio Perm				0.02		0.01		
v/c Ratio	0.39	0.20	0.13	0.07	0.38	0.07		
Uniform Delay, d1	20.2	5.8	14.4	12.9	17.1	15.9		
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00		
Incremental Delay, d2	1.1	0.0	0.2	0.1	0.6	0.1		
Delay (s)	21.2	5.9	14.5	12.9	17.7	15.9		
Level of Service	C	A	B	B	B	B		
Approach Delay (s)		8.0	14.4		17.0			
Approach LOS		A	B		B			

Intersection Summary				
HCM Average Control Delay	12.3	HCM Level of Service	B	
HCM Volume to Capacity ratio	0.41			
Actuated Cycle Length (s)	50.0	Sum of lost time (s)	18.0	
Intersection Capacity Utilization	36.7%	ICU Level of Service	A	
Analysis Period (min)	15			
c Critical Lane Group				

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SWL	SWT	SWR
Lane Configurations												
Volume (vph)	123	291	15	55	401	370	11	70	19	298	127	176
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0		6.0	6.0		5.0	5.0		5.0	5.0	5.0
Lane Util. Factor	1.00	0.91		1.00	0.91		1.00	1.00		1.00	1.00	1.00
Frt	1.00	0.99		1.00	0.94		1.00	0.97		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1773	6048		1770	4758		1770	1802		1770	1863	1583
Flt Permitted	0.95	1.00		0.95	1.00		0.97	1.00		0.69	1.00	1.00
Satd. Flow (perm)	1773	6048		1770	4758		1746	1802		1293	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	134	316	16	61	534	402	12	76	21	286	138	191
RTOR Reduction (vph)	3	4	0	0	191	0	0	7	0	0	0	130
Lane Group Flow (vph)	139	328	0	61	836	0	12	90	0	286	138	61
Turn Type	Prot			Prot			Perm			Perm		Perm
Protected Phases	7	4		3	8			2			6	
Permitted Phases							2			6		6
Actuated Green, G (s)	13.1	32.7		5.9	25.5		26.3	26.3		26.3	26.3	26.3
Effective Green, g (s)	13.1	32.7		5.9	25.5		26.3	26.3		26.3	26.3	26.3
Actuated g/C Ratio	0.15	0.38		0.08	0.30		0.32	0.32		0.32	0.32	0.32
Clearance Time (s)	6.0	6.0		6.0	6.0		5.0	5.0		5.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	280	1980		147	1521		395	572		410	591	502
v/s Ratio Prot	c0.08	0.06		0.03	c0.18			0.05			0.07	
v/s Ratio Perm							0.01			c0.22		0.04
v/c Ratio	0.50	0.16		0.41	0.55		0.03	0.16		0.70	0.23	0.12
Uniform Delay, d1	31.8	16.2		36.1	23.3		19.5	20.3		24.9	20.9	20.1
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	1.4	0.0		1.9	0.4		0.0	0.1		5.4	0.2	0.1
Delay (s)	33.3	16.3		38.0	23.7		19.5	20.5		30.3	21.1	20.2
Level of Service	C	B		D	C		B	C		C	C	C
Approach Delay (s)		21.3			24.6			20.4			25.1	
Approach LOS		C			C			C			C	

Intersection Summary				
HCM Average Control Delay	23.6	HCM Level of Service	C	
HCM Volume to Capacity ratio	0.60			
Actuated Cycle Length (s)	82.9	Sum of lost time (s)	17.0	
Intersection Capacity Utilization	50.4%	ICU Level of Service	B	
Analysis Period (min)	15			
c Critical Lane Group				

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	439	249	438	259	202	256
Ideal Flow (vphp)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0	6.0
Lane Util. Factor	0.97	0.91	0.91	0.88	0.97	0.88
Frt	1.00	1.00	1.00	0.85	1.00	0.85
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	3433	5085	5085	2787	3433	2787
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	3433	5085	5085	2787	3433	2787
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	477	271	476	282	220	322
RTOR Reduction (vph)	0	0	0	0	0	265
Lane Group Flow (vph)	477	271	476	282	220	57
Turn Type	Prot			Perm		Perm
Protected Phases	7	4	8		1	
Permitted Phases				8		1
Actuated Green, G (s)	14.5	35.0	14.5	14.5	10.1	10.1
Effective Green, g (s)	14.5	35.0	14.5	14.5	10.1	10.1
Actuated g/C Ratio	0.25	0.61	0.25	0.25	0.18	0.18
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	872	3117	1291	708	607	493
v/s Ratio Prot	c0.14	0.05	0.09		c0.06	
v/s Ratio Perm				c0.10		0.02
v/c Ratio	0.55	0.09	0.37	0.40	0.36	0.12
Uniform Delay, d1	18.5	4.5	17.5	17.7	23.7	19.7
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.7	0.0	0.2	0.4	0.4	0.1
Delay (s)	19.2	4.5	17.7	18.0	21.0	19.8
Level of Service	B	A	B	B	C	B
Approach Delay (s)		13.9	17.8		20.3	
Approach LOS		B	B		C	

Intersection Summary				
HCM Average Control Delay	17.0	HCM Level of Service		B
HCM Volume to Capacity ratio	0.44			
Actuated Cycle Length (s)	57.1	Sum of lost time (s)		18.0
Intersection Capacity Utilization	41.7%	ICU Level of Service		A
Analysis Period (min)	15			
c Critical Lane Group				

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	37	316	32	112	296	218	21	70	56	121	75	22
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	6.0		5.0	5.0		5.0	5.0		5.0	5.0	
Lane Util. Factor	1.00	0.91		1.00	0.91		1.00	1.00		1.00	1.00	
Frt	1.00	0.96		1.00	0.94		1.00	0.98		1.00	0.97	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	5016		1720	4763		1770	1733		1770	1799	
Flt Permitted	0.95	1.00		0.95	1.00		0.69	1.00		0.95	1.00	
Satd. Flow (perm)	1770	5016		1770	4763		1283	1733		1770	1799	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	40	343	35	122	304	237	23	76	61	132	82	24
RTOR Reduction (vph)	0	9	0	0	56	0	0	23	0	0	7	0
Lane Group Flow (vph)	40	369	0	122	485	0	23	117	0	132	99	0
Turn Type	Prot			Prot			Perm			Prot		
Protected Phases	7	4		3	8			2		1	5	
Permitted Phases							2					
Actuated Green, G (s)	4.6	14.2		10.7	20.4		10.5	10.5		11.1	26.9	
Effective Green, g (s)	4.6	14.2		10.7	20.4		10.5	10.5		11.1	26.9	
Actuated g/C Ratio	0.07	0.21		0.16	0.30		0.15	0.15		0.15	0.39	
Clearance Time (s)	6.0	6.0		6.0	6.0		5.0	5.0		5.0	5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	116	1035		275	1412		201	273		286	703	
v/s Ratio Prot	0.02	0.07		c0.07	c0.10			c0.07		c0.07	0.05	
v/s Ratio Perm							0.02					
v/c Ratio	0.34	0.36		0.44	0.33		0.11	0.43		0.46	0.14	
Uniform Delay, d1	30.7	23.4		26.4	18.9		24.9	28.2		26.1	13.5	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	1.8	0.2		1.1	0.1		0.3	1.1		1.2	0.1	
Delay (s)	32.5	23.6		27.5	19.0		25.1	27.3		27.3	13.6	
Level of Service	C	C		C	B		C	C		C	B	
Approach Delay (s)		24.5			20.5			27.0			21.2	
Approach LOS		C			C			C			C	

Intersection Summary				
HCM Average Control Delay	22.4	HCM Level of Service		C
HCM Volume to Capacity ratio	0.43			
Actuated Cycle Length (s)	68.8	Sum of lost time (s)		22.0
Intersection Capacity Utilization	46.1%	ICU Level of Service		A
Analysis Period (min)	15			
c Critical Lane Group				

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	71	417	500	100	104	54
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0	6.0
Lane Util. Factor	1.00	0.91	0.91	1.00	1.00	1.00
Frt	1.00	1.00	1.00	0.85	1.00	0.85
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1770	5085	5085	1583	1770	1583
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1770	5085	5085	1583	1770	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	77	453	609	109	113	59
RTOR Reduction (vph)	0	0	0	77	0	47
Lane Group Flow (vph)	77	453	609	32	113	12
Turn Type	Prot			Perm		Perm
Protected Phases	7	4	8		1	
Permitted Phases				8		1
Actuated Green, G (s)	8.2	26.0	13.8	13.8	9.5	9.5
Effective Green, g (s)	8.2	26.0	13.8	13.8	9.5	9.5
Actuated g/C Ratio	0.13	0.55	0.29	0.29	0.20	0.20
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	231	2783	1477	460	354	317
v/s Ratio Prot	c0.04	0.09	c0.12		c0.06	
v/s Ratio Perm				0.02		0.01
v/c Ratio	0.33	0.16	0.41	0.07	0.32	0.04
Uniform Delay, d1	18.6	6.3	13.6	12.2	16.2	15.3
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.9	0.0	0.2	0.1	0.5	0.0
Delay (s)	19.6	6.4	13.8	12.3	16.8	15.4
Level of Service	B	A	B	B	B	B
Approach Delay (s)		7.4	13.5		16.3	
Approach LOS		A	B		B	

Intersection Summary			
HCM Average Control Delay	11.6	HCM Level of Service	B
HCM Volume to Capacity ratio	0.37		
Actuated Cycle Length (s)	47.8	Sum of lost time (s)	18.0
Intersection Capacity Utilization	36.5%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SWL	SWT	SWR
Lane Configurations												
Volume (vph)	139	480	15	27	345	141	19	133	71	138	71	121
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0		6.0	6.0		6.0	6.0		6.0	6.0	6.0
Lane Util. Factor	1.00	0.91		1.00	0.91		1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00		1.00	0.96		1.00	0.95		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	5085		1770	4864		1770	1758		1770	1863	1583
Flt Permitted	0.95	1.00		0.95	1.00		0.71	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1770	5085		1770	4864		1317	1758		1691	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	147	522	16	29	375	153	21	145	77	150	77	132
RTOR Reduction (vph)	0	2	0	0	52	0	0	14	0	0	0	96
Lane Group Flow (vph)	147	536	0	29	476	0	21	208	0	150	77	36
Turn Type	Prot			Prot			Perm			Perm		Perm
Protected Phases	7	4		3	8			2			6	
Permitted Phases							2			6		6
Actuated Green, G (s)	11.4	26.2		2.5	17.3		15.0	15.0		15.0	15.0	15.0
Effective Green, g (s)	11.4	26.2		2.5	17.3		15.0	15.0		15.0	15.0	15.0
Actuated g/C Ratio	0.18	0.42		0.04	0.28		0.24	0.24		0.24	0.24	0.24
Clearance Time (s)	6.0	6.0		6.0	6.0		6.0	6.0		6.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	327	2150		77	1384		342	456		273	483	411
v/s Ratio Prot	c0.08	0.11		0.02	c0.10			0.12			0.04	
v/s Ratio Perm							0.02			c0.14		0.02
v/c Ratio	0.45	0.25		0.40	0.35		0.06	0.46		0.55	0.16	0.08
Uniform Delay, d1	22.4	11.4		26.9	17.7		17.2	19.2		19.7	17.7	17.3
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	1.0	0.1		3.7	0.2		0.1	0.7		2.3	0.2	0.1
Delay (s)	23.3	11.5		32.6	17.9		17.3	19.9		22.0	17.8	17.4
Level of Service	C	B		C	B		B	B		C	B	B
Approach Delay (s)		14.0			18.6			19.7			19.4	
Approach LOS		B			B			B			B	

Intersection Summary			
HCM Average Control Delay	17.2	HCM Level of Service	B
HCM Volume to Capacity ratio	0.46		
Actuated Cycle Length (s)	61.7	Sum of lost time (s)	17.0
Intersection Capacity Utilization	64.8%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
28: Kapolei Parkway & Kualakai Parkway

2013 background
PM Peak Hour

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	201	252	252	250	390	419
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0	6.0
Lane Util. Factor	0.97	0.91	0.91	0.88	0.97	0.88
Frt	1.00	1.00	1.00	0.85	1.00	0.85
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	3433	6085	6085	2787	3433	2787
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	3433	6085	6085	2787	3433	2787
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	305	274	274	272	424	456
RTOR Reduction (vph)	0	0	0	0	0	338
Lane Group Flow (vph)	305	274	274	272	424	117
Turn Type	Prot			Perm		Perm
Protected Phases	7	4	8		1	
Permitted Phases				8		1
Actuated Green, G (s)	11.5	30.2	12.7	12.7	14.6	14.6
Effective Green, g (s)	11.5	30.2	12.7	12.7	14.6	14.6
Actuated g/C Ratio	0.20	0.53	0.22	0.22	0.26	0.26
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	695	2734	1137	623	882	716
v/s Ratio Prot	c0.09	0.05	0.05		c0.12	
v/s Ratio Perm				c0.10		0.04
v/c Ratio	0.44	0.10	0.24	0.44	0.48	0.16
Uniform Delay, d1	19.8	5.6	18.1	19.0	17.9	16.4
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.4	0.0	0.1	0.5	0.4	0.1
Delay (s)	20.3	5.6	18.2	19.5	18.3	16.5
Level of Service	C	A	B	B	B	B
Approach Delay (s)		13.8	18.8		17.4	
Approach LOS		B	B		B	

Intersection Summary				
HCM Average Control Delay	16.7	HCM Level of Service		B
HCM Volume to Capacity ratio	0.45			
Actuated Cycle Length (s)	56.8	Sum of lost time (s)		18.0
Intersection Capacity Utilization	39.0%	ICU Level of Service		A
Analysis Period (min)	15			
c Critical Lane Group				

HCM Signalized Intersection Capacity Analysis
7: Kapolei Parkway & Kamaaha Avenue

Total 2013 with project
AM Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	81	333	99	105	428	137	105	238	151	158	237	81
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0		6.0	6.0		5.0	5.0		5.0	5.0	
Lane Util. Factor	1.00	0.91		1.00	0.91		1.00	1.00		1.00	1.00	
Frt	1.00	0.97		1.00	0.96		1.00	0.94		1.00	0.95	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	4910		1770	4900		1770	1750		1770	1794	
Flt Permitted	0.95	1.00		0.95	1.00		0.57	1.00		0.95	1.00	
Satd. Flow (perm)	1770	4910		1770	4900		1062	1750		1770	1794	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	88	362	108	115	465	149	114	259	175	172	225	88
RTOR Reduction (vph)	0	34	0	0	35	0	0	16	0	0	12	0
Lane Group Flow (vph)	88	435	0	115	579	0	114	413	0	172	301	0
Turn Type	Prot			Prot			Perm			Prot		
Protected Phases	7	4		3	8			2		1	6	
Permitted Phases							2					
Actuated Green, G (s)	8.9	19.0		12.5	21.6		30.8	30.8		15.8	51.6	
Effective Green, g (s)	8.9	19.0		12.5	21.6		30.8	30.8		15.8	51.6	
Actuated g/C Ratio	0.09	0.18		0.13	0.22		0.31	0.31		0.16	0.52	
Clearance Time (s)	6.0	6.0		6.0	6.0		5.0	5.0		5.0	6.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	159	882		223	1068		330	544		282	929	
v/s Ratio Prot	0.05	0.09		c0.06	c0.12			c0.24		c0.10	0.17	
v/s Ratio Perm							0.11					
v/c Ratio	0.55	0.49		0.52	0.54		0.35	0.76		0.61	0.32	
Uniform Delay, d1	43.2	36.4		40.6	34.4		28.4	30.8		38.6	13.7	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	4.1	0.4		2.0	0.6		0.5	6.0		3.7	0.2	
Delay (s)	47.3	36.8		42.5	34.9		27.0	36.8		42.5	13.9	
Level of Service	D	D		D	C		C	D		D	B	
Approach Delay (s)		38.8			36.1			34.8			24.0	
Approach LOS		D			D			C			C	

Intersection Summary				
HCM Average Control Delay	33.8	HCM Level of Service		C
HCM Volume to Capacity ratio	0.66			
Actuated Cycle Length (s)	99.1	Sum of lost time (s)		22.0
Intersection Capacity Utilization	65.2%	ICU Level of Service		C
Analysis Period (min)	15			
c Critical Lane Group				

HCM Signalized Intersection Capacity Analysis
10: Kapolei Parkway & Kinoiki Street

Total 2013 with project
AM Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	85	518	34	83	566	109	22	5	52	135	13	97
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Lane Util. Factor	1.00	0.91	1.00	0.97	0.91	1.00	0.97	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	5085	1583	3433	5085	1583	3433	1863	1583	1770	1863	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	5085	1583	3433	5085	1583	3433	1863	1583	1770	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	92	563	37	90	653	109	24	9	57	147	14	105
RTOR Reduction (vph)	0	0	27	0	0	83	0	0	48	0	0	75
Lane Group Flow (vph)	92	563	10	90	653	26	24	9	9	147	14	30
Turn Type	Prot		Perm	Prot		Perm	Prot		Perm	Prot		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8			2			6
Actuated Green, G (s)	7.7	19.1	19.1	5.9	17.3	17.3	2.2	19.8	19.8	12.1	29.7	29.7
Effective Green, g (s)	7.7	19.1	19.1	5.9	17.3	17.3	2.2	19.8	19.8	12.1	29.7	29.7
Actuated g/C Ratio	0.11	0.27	0.27	0.08	0.24	0.24	0.03	0.15	0.15	0.17	0.29	0.29
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	190	1361	421	282	1224	381	105	280	238	298	536	456
v/s Ratio Prot	c0.05	0.11		0.03	c0.13		0.01	0.00		c0.08	0.01	
v/s Ratio Perm			0.01			0.02			0.01			c0.02
v/c Ratio	0.48	0.42	0.02	0.32	0.53	0.07	0.23	0.03	0.04	0.49	0.03	0.07
Uniform Delay, d1	30.2	21.8	19.5	31.1	23.8	21.1	34.0	28.1	28.1	27.1	18.4	18.6
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.9	0.2	0.0	0.7	0.4	0.1	1.1	0.0	0.1	1.3	0.0	0.1
Delay (s)	32.2	22.0	19.5	31.8	24.2	21.2	35.1	28.1	28.2	28.4	18.4	18.6
Level of Service	C	C	B	C	C	C	D	C	C	C	B	B
Approach Delay (s)		23.2			24.6			28.6			24.0	
Approach LOS		C			C			C			C	

Intersection Summary			
HCM Average Control Delay	24.2	HCM Level of Service	C
HCM Volume to Capacity ratio	0.37		
Actuated Cycle Length (s)	71.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	46.4%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
13: Kapolei Parkway & Renton Road

Total 2013 with project
AM Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SWL	SWT	SWR
Lane Configurations												
Volume (vph)	125	304	15	58	512	370	11	70	19	296	127	179
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0		6.0	6.0		5.0	5.0		5.0	5.0	5.0
Lane Util. Factor	1.00	0.91		1.00	0.91		1.00	1.00		1.00	1.00	1.00
Frt	1.00	0.99		1.00	0.94		1.00	0.97		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1773	5050		1770	4798		1770	1802		1770	1863	1583
Flt Permitted	0.95	1.00		0.95	1.00		0.57	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1773	5050		1770	4798		1246	1802		1770	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	136	330	16	51	557	402	12	76	21	295	138	191
RTOR Reduction (vph)	3	4	0	0	98	0	0	7	0	0	0	131
Lane Group Flow (vph)	133	342	0	51	863	0	12	90	0	295	138	60
Turn Type	Prot			Prot			Perm			Perm		Perm
Protected Phases	7	4		3	8			2			6	
Permitted Phases							2			6		6
Actuated Green, G (s)	13.2	33.4		7.0	27.2		26.6	26.6		26.6	26.6	26.6
Effective Green, g (s)	13.2	33.4		7.0	27.2		26.6	26.6		26.6	26.6	26.6
Actuated g/C Ratio	0.18	0.46		0.08	0.32		0.32	0.32		0.32	0.32	0.32
Clearance Time (s)	6.0	6.0		6.0	6.0		5.0	5.0		6.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	278	2310		140	1545		394	569		406	595	506
v/s Ratio Prot	c0.08	0.07		0.03	c0.18			0.05			0.07	
v/s Ratio Perm							0.01			c0.22		0.04
v/c Ratio	0.50	0.17		0.41	0.56		0.03	0.16		0.71	0.23	0.12
Uniform Delay, d1	32.3	16.3		36.6	23.4		19.8	20.7		25.3	21.2	20.4
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	1.4	0.0		1.9	0.4		0.0	0.1		5.6	0.2	0.1
Delay (s)	33.7	16.3		38.4	23.8		19.9	20.8		30.9	21.4	20.5
Level of Service	C	B		D	C		B	C		C	C	C
Approach Delay (s)		21.3			24.7			20.7			26.5	
Approach LOS		C			C			C			C	

Intersection Summary			
HCM Average Control Delay	24.0	HCM Level of Service	C
HCM Volume to Capacity ratio	0.61		
Actuated Cycle Length (s)	83.9	Sum of lost time (s)	17.0
Intersection Capacity Utilization	50.8%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	475	255	464	259	232	353
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0	6.0
Lane Util. Factor	0.97	0.91	0.91	0.88	0.97	0.88
Frt	1.00	1.00	1.00	0.85	1.00	0.85
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	3433	5085	5088	2787	3433	2787
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	3433	5085	5088	2787	3433	2787
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	516	288	504	282	220	384
RTOR Reduction (vph)	0	0	0	0	0	317
Lane Group Flow (vph)	516	288	504	282	220	67
Turn Type	Prot			Perm		Perm
Protected Phases	7	4	8		1	
Permitted Phases				8		1
Actuated Green, G (s)	15.4	36.4	15.0	15.0	10.2	10.2
Effective Green, g (s)	15.4	36.4	15.0	15.0	10.2	10.2
Actuated g/C Ratio	0.26	0.62	0.26	0.26	0.17	0.17
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	902	3169	1302	713	566	485
v/s Ratio Prot	c0.15	0.06	0.10		c0.06	
v/s Ratio Perm				c0.10		0.02
v/c Ratio	0.57	0.09	0.39	0.40	0.37	0.14
Uniform Delay, d1	18.7	4.5	18.0	18.0	21.4	20.5
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	2.9	0.0	0.2	0.4	0.4	0.1
Delay (s)	19.6	4.5	18.2	18.4	21.7	20.5
Level of Service	B	A	B	B	C	C
Approach Delay (s)		14.2	18.3		21.0	
Approach LOS		B	B		C	

Intersection Summary			
HCM Average Control Delay	17.5	HCM Level of Service	B
HCM Volume to Capacity ratio	0.46		
Actuated Cycle Length (s)	58.6	Sum of lost time (s)	18.0
Intersection Capacity Utilization	43.3%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	9	302	677	7	5	4
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	7	328	736	8	5	4
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	743				1077	736
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	743				1077	736
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	99				98	99
cM capacity (veh/h)	884				241	419

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1	SB 2
Volume Total	7	328	736	8	5	4
Volume Left	7	0	0	0	5	0
Volume Right	0	0	0	8	0	4
cSH	884	1700	1700	1700	241	419
Volume to Capacity	0.01	0.19	0.43	0.00	0.02	0.01
Queue Length 95th (ft)	1	0	0	0	2	1
Control Delay (s)	9.2	0.0	0.0	0.0	20.3	13.7
Lane LOS	A				C	B
Approach Delay (s)	0.2		0.0		17.4	
Approach LOS					C	

Intersection Summary			
Average Delay	0.2		
Intersection Capacity Utilization	46.0%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	37	484	32	112	361	218	21	70	55	121	75	22
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Lane Util. Factor	1.00	0.91		1.00	0.91		1.00	1.00		1.00	1.00	
Frt	1.00	0.98		1.00	0.95		1.00	0.93		1.00	0.97	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	5026		1770	4817		1770	1735		1770	1799	
Flt Permitted	0.95	1.00		0.95	1.00		0.60	1.00		0.95	1.00	
Satd. Flow (perm)	1770	5026		1770	4812		1283	1735		1770	1799	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	40	526	35	122	425	237	23	79	61	132	82	24
RTOR Reduction (vph)	0	6	0	0	77	0	0	20	0	0	7	0
Lane Group Flow (vph)	40	555	0	122	585	0	23	117	0	132	99	0
Turn Type	Prot			Prot			Perm			Prot		
Protected Phases	7	4		3	8			2		1	6	
Permitted Phases							2					
Actuated Green, G (s)	4.6	16.2		11.0	22.7		11.0	11.0		11.4	27.4	
Effective Green, g (s)	4.6	16.2		11.0	22.7		11.0	11.0		11.4	27.4	
Actuated g/C Ratio	0.06	0.23		0.15	0.32		0.15	0.15		0.16	0.38	
Clearance Time (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	111	1138		272	1526		197	267		282	688	
v/s Ratio Prot	0.02	0.09		c0.07	c0.12			c0.07		c0.07	0.05	
v/s Ratio Perm							0.02					
v/c Ratio	0.36	0.41		0.45	0.39		0.12	0.44		0.47	0.14	
Uniform Delay, d1	32.2	23.9		27.5	19.0		26.1	27.5		27.3	14.4	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	2.0	0.2		1.2	0.2		0.3	1.1		1.3	0.1	
Delay (s)	34.2	23.9		28.7	19.2		26.4	28.6		28.6	14.5	
Level of Service	C	C		C	B		C	C		C	B	
Approach Delay (s)		24.7			20.7			28.3			22.3	
Approach LOS		C			C			C			C	

Intersection Summary				
HCM Average Control Delay	22.8	HCM Level of Service		C
HCM Volume to Capacity ratio	0.46			
Actuated Cycle Length (s)	71.8	Sum of lost time (s)		22.0
Intersection Capacity Utilization	47.0%	ICU Level of Service		A
Analysis Period (min)	15			
c Critical Lane Group				

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	71	391	121	245	527	100	126	34	256	104	33	54
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	5.0	6.0	6.0	5.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Lane Util. Factor	1.00	0.91	1.00	0.97	0.91	1.00	0.97	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	0.95	1.00	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1773	5085	1583	3433	5085	1583	3433	1863	1583	1770	1863	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1773	5085	1583	3433	5085	1583	3433	1863	1583	1770	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	77	417	132	266	573	109	137	37	278	113	36	59
RTOR Reduction (vph)	0	0	104	0	0	76	0	0	246	0	0	51
Lane Group Flow (vph)	77	417	28	266	573	33	137	37	32	113	36	8
Turn Type	Prot		Perm	Prot		Perm	Prot		Perm	Prot		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8			2			6
Actuated Green, G (s)	7.4	14.8	14.8	12.1	19.3	19.3	8.6	7.8	7.8	10.3	9.5	9.5
Effective Green, g (s)	7.4	14.8	14.8	12.1	19.3	19.3	8.6	7.8	7.8	10.3	9.5	9.5
Actuated g/C Ratio	0.11	0.21	0.21	0.18	0.28	0.28	0.12	0.11	0.11	0.15	0.14	0.14
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	190	1070	336	864	1426	444	429	211	179	265	257	219
v/s Ratio Prot	0.04	0.08		c0.08	c0.11		0.04	0.02		c0.06	0.02	
v/s Ratio Perm			0.02			0.02			c0.02			0.01
v/c Ratio	0.41	0.39	0.08	0.44	0.40	0.07	0.32	0.18	0.18	0.43	0.14	0.04
Uniform Delay, d1	28.8	23.3	21.7	26.3	20.1	18.2	27.4	27.8	27.8	26.8	26.1	25.7
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.4	0.2	0.1	0.5	0.2	0.1	0.4	0.4	0.5	1.1	0.3	0.1
Delay (s)	30.1	23.5	21.8	26.8	20.3	18.2	27.9	28.0	28.1	27.7	26.3	25.8
Level of Service	C	C	C	C	C	B	C	C	C	C	C	C
Approach Delay (s)		23.9			21.6			28.0			26.9	
Approach LOS		C			C			C			C	

Intersection Summary				
HCM Average Control Delay	24.0	HCM Level of Service		C
HCM Volume to Capacity ratio	0.41			
Actuated Cycle Length (s)	69.8	Sum of lost time (s)		24.0
Intersection Capacity Utilization	44.0%	ICU Level of Service		A
Analysis Period (min)	15			
c Critical Lane Group				

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SWL	SWT	SWR
Lane Configurations												
Volume (vph)	148	536	16	27	360	141	89	133	71	138	71	121
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	5.0
Lane Util. Factor	1.00	0.91		1.00	0.91		1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00		1.00	0.96		1.00	0.95		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	5085		1770	4886		1770	1755		1770	1863	1583
Flt Permitted	0.95	1.00		0.95	1.00		0.71	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1770	5085		1770	4886		1317	1755		1831	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	162	583	16	29	483	153	21	145	77	150	77	132
RTOR Reduction (vph)	0	2	0	0	45	0	0	14	0	0	0	98
Lane Group Flow (vph)	162	597	0	29	541	0	21	208	0	150	77	34
Turn Type	Prot			Prot			Perm			Perm		Perm
Protected Phases	7	4		3	8			2			6	
Permitted Phases							2			6		6
Actuated Green, G (s)	12.2	28.6		2.5	18.9		15.5	15.5		15.5	15.5	15.5
Effective Green, g (s)	12.2	28.6		2.5	18.9		15.5	15.5		15.5	15.5	15.5
Actuated g/C Ratio	0.19	0.44		0.04	0.29		0.24	0.24		0.24	0.24	0.24
Clearance Time (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	334	2239		66	1427		308	453		255	478	406
v/s Ratio Prot	c0.09	0.12		0.02	c0.11			0.12			0.04	
v/s Ratio Perm							0.02			c0.16		0.02
v/c Ratio	0.49	0.27		0.43	0.38		0.06	0.46		0.57	0.16	0.08
Uniform Delay, d1	23.4	11.4		30.4	18.2		18.2	20.3		20.9	18.7	18.3
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	1.1	0.1		4.3	0.2		0.1	0.7		2.6	0.2	0.1
Delay (s)	24.8	11.5		34.7	18.4		18.2	21.0		23.7	18.8	18.4
Level of Service	C	B		C	B		B	C		C	B	B
Approach Delay (s)		14.3			19.2			20.8			20.7	
Approach LOS		B			B			C			C	

Intersection Summary				
HCM Average Control Delay	17.8	HCM Level of Service	B	
HCM Volume to Capacity ratio	0.47			
Actuated Cycle Length (s)	64.7	Sum of lost time (s)	17.0	
Intersection Capacity Utilization	66.6%	ICU Level of Service	B	
Analysis Period (min)	15			
c Critical Lane Group				

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	432	322	318	260	399	565
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0	6.0
Lane Util. Factor	0.97	0.91	0.91	0.88	0.97	0.88
Frt	1.00	1.00	1.00	0.85	1.00	0.85
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	3433	5085	5085	2787	3433	2787
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	3433	5085	5085	2787	3433	2787
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	470	350	346	272	434	614
RTOR Reduction (vph)	0	0	0	0	0	457
Lane Group Flow (vph)	470	350	346	272	434	157
Turn Type	Prot			Perm		Perm
Protected Phases	7	4	8		1	
Permitted Phases				8		1
Actuated Green, G (s)	16.5	38.6	14.1	14.1	16.3	16.3
Effective Green, g (s)	16.5	38.6	14.1	14.1	16.3	16.3
Actuated g/C Ratio	0.24	0.56	0.22	0.22	0.26	0.26
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	833	2833	1122	616	878	711
v/s Ratio Prot	c0.14	0.07	0.07		c0.12	
v/s Ratio Perm				c0.10		0.06
v/c Ratio	0.56	0.12	0.31	0.44	0.49	0.22
Uniform Delay, d1	21.2	5.7	20.8	21.5	20.2	18.8
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.9	0.0	0.2	0.5	0.4	0.2
Delay (s)	22.1	5.7	21.0	22.0	20.6	18.9
Level of Service	C	A	C	C	C	B
Approach Delay (s)		15.5	21.4		19.6	
Approach LOS		B	C		B	

Intersection Summary				
HCM Average Control Delay	18.7	HCM Level of Service	B	
HCM Volume to Capacity ratio	0.60			
Actuated Cycle Length (s)	69.0	Sum of lost time (s)	18.0	
Intersection Capacity Utilization	44.8%	ICU Level of Service	A	
Analysis Period (min)	15			
c Critical Lane Group				

HCM Unsignalized Intersection Capacity Analysis
35: Roosevelt Avenue & West Entrance

Total 2013 with project
PM Peak Hour

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	38	799	458	29	42	27
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	41	868	498	32	46	29
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	529				1438	498
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	529				1438	498
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	96				68	95
cM capacity (veh/h)	1038				141	572

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1	SB 2
Volume Total	41	868	498	32	46	29
Volume Left	41	0	0	0	46	0
Volume Right	0	0	0	32	0	29
cSH	1038	1700	1700	1700	141	572
Volume to Capacity	0.04	0.50	0.29	0.02	0.32	0.05
Queue Length 95th (ft)	3	0	0	0	32	4
Control Delay (s)	8.6	0.0	0.0	0.0	42.4	11.6
Lane LOS	A				E	B
Approach Delay (s)	0.4		0.0		30.3	
Approach LOS					D	

Intersection Summary				
Average Delay	1.8			
Intersection Capacity Utilization	51.5%	ICU Level of Service		A
Analysis Period (min)	15			

HCM Signalized Intersection Capacity Analysis
7: Kapolei Parkway & Kamaaha Avenue

2015 background without NS extension
AM Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	83	317	101	108	437	140	107	241	164	161	211	83
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Lane Util. Factor	1.00	0.91		1.00	0.91		1.00	1.00		1.00	1.00	
Frt	1.00	0.96		1.00	0.96		1.00	0.94		1.00	0.96	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	4901		1770	4900		1770	1750		1770	1784	
Flt Permitted	0.95	1.00		0.95	1.00		0.57	1.00		0.95	1.00	
Satd. Flow (perm)	1770	4901		1770	4900		1066	1750		1770	1784	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	90	345	110	117	475	152	116	262	178	175	229	90
RTOR Reduction (vph)	0	36	0	0	36	0	0	15	0	0	12	0
Lane Group Flow (vph)	90	419	0	117	592	0	116	422	0	175	307	0
Turn Type	Prot			Prot			Perm			Prot		
Protected Phases	7	4		3	8			2		1	6	
Permitted Phases							2					
Actuated Green, G (s)	9.1	18.2		12.8	21.9		32.1	32.1		16.2	53.3	
Effective Green, g (s)	9.1	18.2		12.8	21.9		32.1	32.1		16.2	53.3	
Actuated g/C Ratio	0.09	0.16		0.13	0.22		0.32	0.32		0.16	0.53	
Clearance Time (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	159	801		224	1069		335	555		283	939	
v/s Ratio Prot	0.05	0.09		c0.07	c0.12			c0.24		c0.10	0.17	
v/s Ratio Perm							0.11					
v/c Ratio	0.57	0.46		0.52	0.56		0.35	0.76		0.62	0.33	
Uniform Delay, d1	44.2	37.3		41.4	36.4		26.5	31.1		39.7	13.7	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	4.6	0.4		2.2	0.8		0.6	5.9		4.0	0.2	
Delay (s)	48.8	37.7		43.6	36.0		27.2	37.1		43.7	13.9	
Level of Service	D	D		D	D		C	D		D	B	
Approach Delay (s)		39.5			37.2			35.0			24.5	
Approach LOS		D			D			C			C	

Intersection Summary					
HCM Average Control Delay	34.5	HCM Level of Service		C	
HCM Volume to Capacity ratio	0.67				
Actuated Cycle Length (s)	101.3	Sum of lost time (s)		22.0	
Intersection Capacity Utilization	66.1%	ICU Level of Service		C	
Analysis Period (min)	15				
c Critical Lane Group					

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	87	554	648	102	135	98
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0	6.0
Lane Util. Factor	1.00	0.91	0.91	1.00	1.00	1.00
Frt	1.00	1.00	1.00	0.85	1.00	0.85
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1770	5085	5085	1583	1770	1583
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1770	5085	5085	1583	1770	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	95	602	704	111	148	107
RTOR Reduction (vph)	0	0	0	77	0	84
Lane Group Flow (vph)	95	602	704	34	148	23
Turn Type	Prot			Perm		Perm
Protected Phases	7	4	8		1	
Permitted Phases				8		1
Actuated Green, G (s)	7.0	29.3	16.3	16.3	11.3	11.3
Effective Green, g (s)	7.0	29.3	16.3	16.3	11.3	11.3
Actuated g/C Ratio	0.13	0.56	0.31	0.31	0.21	0.21
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	236	2833	1578	491	380	340
v/s Ratio Prot	c0.05	0.12	c0.14		c0.08	
v/s Ratio Perm				0.02		0.01
v/c Ratio	0.40	0.21	0.45	0.07	0.39	0.07
Uniform Delay, d1	20.9	5.9	14.5	12.8	17.7	16.5
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.1	0.0	0.2	0.1	0.7	0.1
Delay (s)	22.0	5.9	14.7	12.9	18.4	16.5
Level of Service	C	A	B	B	B	B
Approach Delay (s)		8.1	14.5		17.6	
Approach LOS		A	B		B	

Intersection Summary				
HCM Average Control Delay	12.4	HCM Level of Service		B
HCM Volume to Capacity ratio	0.42			
Actuated Cycle Length (s)	52.6	Sum of lost time (s)		18.0
Intersection Capacity Utilization	39.9%	ICU Level of Service		A
Analysis Period (min)	15			
c Critical Lane Group				

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Volume (vph)	129	316	16	57	523	377	12	71	19	271	129	175
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0		6.0	6.0		5.0	5.0		5.0	5.0	5.0
Lane Util. Factor	1.00	0.91		1.00	0.91		1.00	1.00		1.00	1.00	1.00
Frt	1.00	0.99		1.00	0.94		1.00	0.97		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	5049		1770	4766		1770	1803		1770	1863	1583
Flt Permitted	0.95	1.00		0.65	1.00		0.67	1.00		0.69	1.00	1.00
Satd. Flow (perm)	1770	5049		1770	4766		1244	1803		1292	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	140	343	17	62	568	410	13	77	21	295	140	190
RTOR Reduction (vph)	0	4	0	0	95	0	0	7	0	0	0	129
Lane Group Flow (vph)	140	356	0	62	883	0	13	91	0	295	140	61
Turn Type	Prot			Prot			Perm			Perm		Perm
Protected Phases	7	4		3	8			2			6	
Permitted Phases							2			6		6
Actuated Green, G (s)	13.4	34.9		7.1	28.6		27.6	27.6		27.6	27.6	27.6
Effective Green, g (s)	13.4	34.9		7.1	28.6		27.6	27.6		27.6	27.6	27.6
Actuated g/C Ratio	0.15	0.40		0.08	0.33		0.32	0.32		0.32	0.32	0.32
Clearance Time (s)	6.0	5.0		6.0	6.0		5.0	5.0		5.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	274	2035		145	1574		396	575		412	594	505
v/s Ratio Prot	c0.08	0.07		0.04	c0.19			0.05			0.08	
v/s Ratio Perm							0.01			c0.23		0.04
v/c Ratio	0.51	0.18		0.43	0.56		0.03	0.16		0.72	0.24	0.12
Uniform Delay, d1	33.5	16.6		37.8	23.6		20.3	21.2		26.0	21.7	20.9
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	1.5	0.0		2.0	0.5		0.0	0.1		5.9	0.2	0.1
Delay (s)	35.2	16.6		39.8	24.3		20.3	21.3		31.9	21.9	21.0
Level of Service	D	B		D	C		C	C		C	C	C
Approach Delay (s)		21.8			25.2			21.2			26.3	
Approach LOS		C			C			C			C	

Intersection Summary				
HCM Average Control Delay	24.6	HCM Level of Service		C
HCM Volume to Capacity ratio	0.61			
Actuated Cycle Length (s)	86.6	Sum of lost time (s)		17.0
Intersection Capacity Utilization	61.5%	ICU Level of Service		B
Analysis Period (min)	15			
c Critical Lane Group				

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	446	267	473	257	215	308
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0	6.0
Lane Util. Factor	0.97	0.91	0.91	0.88	0.97	0.88
Frt	1.00	1.00	1.00	0.85	1.00	0.85
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	3433	5085	5085	2787	3433	2787
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	3433	5085	5085	2787	3433	2787
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	485	290	514	280	235	335
RTOR Reduction (vph)	0	0	0	0	0	225
Lane Group Flow (vph)	485	290	514	280	235	80
Turn Type	Prot			Perm		Perm
Protected Phases	7	4	8		1	
Permitted Phases				8		1
Actuated Green, G (s)	14.8	36.2	15.4	15.4	13.6	13.6
Effective Green, g (s)	14.8	36.2	15.4	15.4	13.6	13.6
Actuated g/C Ratio	0.25	0.62	0.26	0.26	0.18	0.18
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	864	3131	1332	730	619	502
v/s Ratio Prot	c0.14	0.06	0.10		c0.07	
v/s Ratio Perm				c0.10		0.02
v/c Ratio	0.56	0.09	0.39	0.40	0.38	0.12
Uniform Delay, d1	19.2	4.6	17.6	17.8	21.2	20.2
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.8	0.0	0.2	0.4	0.4	0.1
Delay (s)	20.0	4.6	18.0	18.2	21.6	20.3
Level of Service	C	A	B	B	C	C
Approach Delay (s)		14.3	18.1		20.8	
Approach LOS		B	B		C	

Intersection Summary			
HCM Average Control Delay	17.4	HCM Level of Service	B
HCM Volume to Capacity ratio	0.45		
Actuated Cycle Length (s)	58.8	Sum of lost time (s)	18.0
Intersection Capacity Utilization	43.0%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	38	338	33	115	310	223	21	71	57	123	77	22
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Lane Util. Factor	1.00	0.91		1.00	0.91		1.00	1.00		1.00	1.00	
Frt	1.00	0.99		1.00	0.94		1.00	0.95		1.00	0.91	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	5017		1770	4770		1770	1736		1770	1601	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	5017		1770	4770		1770	1736		1770	1601	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	41	367	36	125	340	242	23	77	62	134	84	24
RTOR Reduction (vph)	0	0	0	0	90	0	0	20	0	0	7	0
Lane Group Flow (vph)	41	394	0	125	492	0	23	119	0	134	101	0
Turn Type	Prot			Prot			Perm			Prot		
Protected Phases	7	4		3	8			2		1	6	
Permitted Phases							2					
Actuated Green, G (s)	4.6	14.6		11.0	21.1		10.9	10.9		11.4	27.3	
Effective Green, g (s)	4.6	14.6		11.0	21.1		10.9	10.9		11.4	27.3	
Actuated g/C Ratio	0.06	0.21		0.16	0.30		0.15	0.15		0.16	0.39	
Clearance Time (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	114	1046		279	1440		260	271		289	703	
v/s Ratio Prot	0.02	0.08		c0.07	c0.10			c0.07		c0.08	0.06	
v/s Ratio Perm							0.02					
v/c Ratio	0.36	0.38		0.45	0.34		0.12	0.44		0.46	0.14	
Uniform Delay, d1	31.3	23.7		26.7	16.0		25.4	26.7		26.5	13.8	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	1.9	0.2		1.1	0.1		0.3	1.1		1.2	0.1	
Delay (s)	33.3	24.0		27.8	16.1		25.6	27.9		27.7	13.8	
Level of Service	C	C		C	B		C	C		C	B	
Approach Delay (s)		24.6			20.7			27.5			21.5	
Approach LOS		C			C			C			C	

Intersection Summary			
HCM Average Control Delay	22.7	HCM Level of Service	C
HCM Volume to Capacity ratio	0.44		
Actuated Cycle Length (s)	69.9	Sum of lost time (s)	22.0
Intersection Capacity Utilization	46.8%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	72	461	600	101	106	55
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0	6.0
Lane Util. Factor	1.00	0.91	0.91	1.00	1.00	1.00
Frt	1.00	1.00	1.00	0.85	1.00	0.85
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1770	5085	5085	1583	1770	1583
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1770	5085	5085	1583	1770	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	78	490	652	110	115	60
RTOR Reduction (vph)	0	0	0	77	0	48
Lane Group Flow (vph)	78	490	652	33	115	12
Turn Type	Prot			Perm		Perm
Protected Phases	7	4	8		1	
Permitted Phases				8		1
Actuated Green, G (s)	6.3	26.8	14.5	14.5	9.7	9.7
Effective Green, g (s)	6.3	26.8	14.5	14.5	9.7	9.7
Actuated g/C Ratio	0.13	0.55	0.30	0.30	0.20	0.20
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	230	2810	1520	473	354	317
v/s Ratio Prot	c0.04	0.10	c0.13		c0.06	
v/s Ratio Perm				0.02		0.01
v/c Ratio	0.34	0.17	0.43	0.07	0.32	0.04
Uniform Delay, d1	19.2	5.4	13.7	12.2	15.6	15.6
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.9	0.0	0.2	0.1	0.6	0.0
Delay (s)	20.1	5.4	13.9	12.2	17.1	15.7
Level of Service	C	A	B	B	B	B
Approach Delay (s)		7.4	13.6		16.6	
Approach LOS		A	B		B	

Intersection Summary			
HCM Average Control Delay	11.6	HCM Level of Service	B
HCM Volume to Capacity ratio	0.38		
Actuated Cycle Length (s)	48.5	Sum of lost time (s)	18.0
Intersection Capacity Utilization	36.5%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SWL	SWT	SWR
Lane Configurations												
Volume (vph)	139	612	16	27	372	144	19	136	73	141	73	113
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0		6.0	6.0		6.0	6.0		6.0	6.0	6.0
Lane Util. Factor	1.00	0.91		1.00	0.91		1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00		1.00	0.96		1.00	0.95		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	5063		1770	4872		1770	1766		1770	1863	1583
Flt Permitted	0.95	1.00		0.95	1.00		0.71	1.00		0.55	1.00	1.00
Satd. Flow (perm)	1770	5063		1770	4872		1314	1766		1028	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	151	557	17	29	404	157	21	148	79	153	79	123
RTOR Reduction (vph)	0	2	0	0	49	0	0	14	0	0	0	91
Lane Group Flow (vph)	151	572	0	29	512	0	21	213	0	153	79	32
Turn Type	Prot			Prot			Perm			Perm		Perm
Protected Phases	7	4		3	8			2			6	
Permitted Phases							2			6		6
Actuated Green, G (s)	11.7	27.3		2.5	18.1		16.6	16.6		16.6	16.6	16.6
Effective Green, g (s)	11.7	27.3		2.5	18.1		16.6	16.6		16.6	16.6	16.6
Actuated g/C Ratio	0.18	0.43		0.04	0.29		0.26	0.26		0.26	0.26	0.26
Clearance Time (s)	6.0	6.0		6.0	6.0		5.0	5.0		5.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	327	2193		70	1391		344	462		269	488	414
v/s Ratio Prot	c0.09	0.11		0.02	c0.11			0.12			0.04	
v/s Ratio Perm							0.02			c0.15		0.02
v/c Ratio	0.46	0.26		0.41	0.37		0.06	0.46		0.57	0.16	0.08
Uniform Delay, d1	23.0	11.5		23.7	18.1		17.6	19.6		20.3	18.0	17.6
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	1.0	0.1		3.9	0.2		0.1	0.7		2.7	0.2	0.1
Delay (s)	24.1	11.7		33.7	18.2		17.6	20.4		23.0	18.2	17.7
Level of Service	C	B		C	B		B	C		C	B	B
Approach Delay (s)		14.2			19.0			20.1			20.1	
Approach LOS		B			B			C			C	

Intersection Summary			
HCM Average Control Delay	17.6	HCM Level of Service	B
HCM Volume to Capacity ratio	0.46		
Actuated Cycle Length (s)	53.4	Sum of lost time (s)	17.0
Intersection Capacity Utilization	55.9%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis — 2015 background without NS extension
26: Kapolei Parkway & Kualakai Parkway — PM Peak Hour

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	291	271	271	266	402	430
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0	6.0
Lane Util. Factor	0.97	0.91	0.91	0.88	0.97	0.88
Frt	1.00	1.00	1.00	0.85	1.00	0.85
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	3433	5085	5085	2787	3433	2787
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	3433	5085	5085	2787	3433	2787
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	316	295	295	289	437	467
RTOR Reduction (vph)	0	0	0	0	0	343
Lane Group Flow (vph)	316	295	295	289	437	124
Turn Type	Prot			Perm		Perm
Protected Phases	7	4	8		1	
Permitted Phases				8		1
Actuated Green, G (s)	11.5	31.1	13.6	13.6	15.5	15.5
Effective Green, g (s)	11.5	31.1	13.6	13.6	15.5	15.5
Actuated g/C Ratio	0.20	0.53	0.23	0.23	0.26	0.26
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	674	2699	1180	647	908	737
v/s Ratio Prot	c0.09	0.06	0.06		c0.13	
v/s Ratio Perm				c0.10		0.04
v/c Ratio	0.47	0.11	0.25	0.45	0.48	0.17
Uniform Delay, d1	20.8	6.8	18.3	19.3	18.2	16.6
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.5	0.0	0.1	0.5	0.4	0.1
Delay (s)	21.4	6.9	18.5	19.8	18.6	16.7
Level of Service	C	A	B	B	B	B
Approach Delay (s)		14.4	19.1		17.6	
Approach LOS		B	B		B	

Intersection Summary				
HCM Average Control Delay	17.1	HCM Level of Service		B
HCM Volume to Capacity ratio	0.47			
Actuated Cycle Length (s)	58.6	Sum of lost time (s)		18.0
Intersection Capacity Utilization	40.0%	ICU Level of Service		A
Analysis Period (min)	15			
c Critical Lane Group				

HCM Signalized Intersection Capacity Analysis — Total 2015 without NS extension with project
7: Kapolei Parkway & Kamaaha Avenue — AM Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	83	498	101	108	519	140	107	241	164	151	211	83
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0		6.0	6.0		5.0	5.0		5.0	5.0	
Lane Util. Factor	1.00	0.91		1.00	0.91		1.00	1.00		1.00	1.00	
Frt	1.00	0.97		1.00	0.97		1.00	0.94		1.00	0.95	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	4956		1770	4923		1770	1760		1770	1784	
Flt Permitted	0.95	1.00		0.95	1.00		0.57	1.00		0.95	1.00	
Satd. Flow (perm)	1770	4956		1770	4923		1058	1760		1770	1784	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	90	541	110	117	564	152	116	262	178	175	229	90
RTOR Reduction (vph)	0	19	0	0	29	0	0	19	0	0	12	0
Lane Group Flow (vph)	90	632	0	117	687	0	116	421	0	175	307	0
Turn Type	Prot			Prot			Perm			Prot		
Protected Phases	7	4		3	8			2		1	6	
Permitted Phases							2					
Actuated Green, G (s)	9.3	22.2		12.7	25.6		32.1	32.1		16.1	53.2	
Effective Green, g (s)	9.3	22.2		12.7	25.6		32.1	32.1		16.1	53.2	
Actuated g/C Ratio	0.09	0.21		0.12	0.24		0.31	0.31		0.15	0.51	
Clearance Time (s)	6.0	6.0		6.0	6.0		5.0	5.0		5.0	5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	157	1047		214	1199		373	534		271	903	
v/s Ratio Prot	0.05	0.13		c0.07	c0.14			c0.24		c0.10	0.17	
v/s Ratio Perm							0.11					
v/c Ratio	0.57	0.60		0.55	0.57		0.36	0.79		0.65	0.34	
Uniform Delay, d1	46.0	37.5		43.5	34.9		28.5	33.4		41.8	15.5	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	5.0	1.0		2.8	0.7		0.7	7.6		5.2	0.2	
Delay (s)	51.0	38.5		46.3	35.6		29.2	41.0		47.0	15.7	
Level of Service	D	D		D	D		C	D		D	B	
Approach Delay (s)		40.0			37.1			38.6			28.8	
Approach LOS		D			D			D			C	

Intersection Summary				
HCM Average Control Delay	36.3	HCM Level of Service		D
HCM Volume to Capacity ratio	0.69			
Actuated Cycle Length (s)	105.1	Sum of lost time (s)		22.0
Intersection Capacity Utilization	67.8%	ICU Level of Service		C
Analysis Period (min)	15			
c Critical Lane Group				

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	87	554	151	55	648	102	82	31	89	136	68	98
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lane Util. Factor	1.00	0.91	1.00	0.97	0.91	1.00	0.97	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	5085	1583	3433	5085	1583	3433	1863	1583	1770	1863	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	5085	1583	3433	5085	1583	3433	1863	1583	1770	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	95	602	197	71	704	111	89	34	75	148	74	107
RTOR Reduction (vph)	0	0	136	0	0	82	0	0	66	0	0	84
Lane Group Flow (vph)	95	602	58	71	704	29	89	34	9	148	74	23
Turn Type	Prot		Perm	Prot		Perm	Prot		Perm	Prot		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8			2			6
Actuated Green, G (s)	8.0	21.4	21.4	5.6	19.0	19.0	6.0	9.2	9.2	12.6	15.7	15.7
Effective Green, g (s)	8.0	21.4	21.4	5.6	19.0	19.0	6.0	9.2	9.2	12.6	15.7	15.7
Actuated g/C Ratio	0.11	0.29	0.29	0.08	0.26	0.26	0.08	0.13	0.13	0.17	0.22	0.22
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	195	1487	466	264	1329	414	283	235	200	304	402	342
v/s Ratio Prot	c0.05	0.12		0.02	c0.14		0.03	0.02		c0.08	c0.04	
v/s Ratio Perm			0.04			0.02			0.01			0.01
v/c Ratio	0.49	0.40	0.12	0.27	0.53	0.07	0.31	0.14	0.05	0.49	0.18	0.07
Uniform Delay, d1	30.4	20.6	18.8	31.6	23.0	20.2	31.4	28.2	27.9	27.2	23.3	22.7
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.9	0.2	0.1	0.6	0.4	0.1	0.5	0.3	0.1	1.2	0.2	0.1
Delay (s)	32.3	20.7	18.9	32.2	23.4	20.3	32.1	28.5	28.0	28.4	23.5	22.8
Level of Service	C	C	B	C	C	C	C	C	C	C	C	C
Approach Delay (s)		21.6			23.7			29.9			25.5	
Approach LOS		C			C			C			C	

Intersection Summary				
HCM Average Control Delay	23.7	HCM Level of Service	C	
HCM Volume to Capacity ratio	0.41			
Actuated Cycle Length (s)	72.7	Sum of lost time (s)	18.0	
Intersection Capacity Utilization	46.5%	ICU Level of Service	A	
Analysis Period (min)	15			
c Critical Lane Group				

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Volume (vph)	141	365	16	67	682	377	12	71	19	271	129	202
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0		6.0	6.0		5.0	5.0		5.0	5.0	5.0
Lane Util. Factor	1.00	0.91		1.00	0.91		1.00	1.00		1.00	1.00	1.00
Frt	1.00	0.99		1.00	0.94		1.00	0.97		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	5054		1770	4800		1770	1803		1770	1863	1583
Flt Permitted	0.95	1.00		0.95	1.00		0.66	1.00		0.69	1.00	1.00
Satd. Flow (perm)	1770	5054		1770	4800		1235	1803		1292	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	153	397	17	82	887	410	13	77	21	295	140	220
RTOR Reduction (vph)	0	3	0	0	76	0	0	7	0	0	0	151
Lane Group Flow (vph)	153	411	0	82	1021	0	13	91	0	295	140	69
Turn Type	Prot			Prot			Perm			Perm		Perm
Protected Phases	7	4		3	8			2			6	
Permitted Phases							2			6		6
Actuated Green, G (s)	14.4	40.5		7.2	33.3		29.7	29.7		29.7	29.7	29.7
Effective Green, g (s)	14.4	40.5		7.2	33.3		29.7	29.7		29.7	29.7	29.7
Actuated g/C Ratio	0.15	0.43		0.08	0.36		0.31	0.31		0.31	0.31	0.31
Clearance Time (s)	6.0	5.0		6.0	6.0		5.0	5.0		5.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	270	2158		135	1695		386	567		406	586	498
v/s Ratio Prot	c0.09	0.08		0.04	c0.21						0.08	
v/s Ratio Perm							0.01			c0.23		0.04
v/c Ratio	0.57	0.19		0.46	0.60		0.03	0.16		0.73	0.24	0.14
Uniform Delay, d1	37.1	18.7		41.7	25.1		22.4	23.4		28.7	24.0	23.2
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	2.7	0.0		2.5	0.8		0.0	0.1		6.4	0.2	0.1
Delay (s)	39.8	18.8		44.2	25.7		22.4	23.5		35.1	24.2	23.3
Level of Service	D	B		D	C		C	C		D	C	C
Approach Delay (s)		23.0			26.7			23.4			28.8	
Approach LOS		C			C			C			C	

Intersection Summary				
HCM Average Control Delay	26.9	HCM Level of Service	C	
HCM Volume to Capacity ratio	0.64			
Actuated Cycle Length (s)	84.4	Sum of lost time (s)	17.0	
Intersection Capacity Utilization	64.3%	ICU Level of Service	C	
Analysis Period (min)	15			
c Critical Lane Group				

HCM Signalized Intersection Capacity Analysis Total 2015 without NS extension with project
28: Kapolei Parkway & Kualakai Parkway AM Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	SBL	SBT	SBR	NWL	NWT	NWR
Lane Configurations												
Volume (vph)	466	316	3	115	493	257	216	256	353	0	155	12
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0		5.0	
Lane Util. Factor	0.97	0.91		0.97	0.91	0.88	0.97	0.95	0.88		0.95	
Frt	1.00	1.00		1.00	1.00	0.85	1.00	1.00	0.85		0.99	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00		1.00	
Satd. Flow (prot)	3433	5085		3433	5085	2787	3433	3535	2787		3501	
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00		1.00	
Satd. Flow (perm)	3433	5085		3433	5085	2787	3433	3535	2787		3501	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	507	343	3	125	536	280	235	278	384	0	168	13
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	253	0	4	0
Lane Group Flow (vph)	507	343	0	125	536	280	235	278	131	0	177	0
Turn Type	Prot			Prot		Perm	Prot		Perm	Prot		
Protected Phases	7	4		3	8		1	6		5		
Permitted Phases						8			6		2	
Actuated Green, G (s)	19.0	27.8		9.1	17.9	17.9	11.9	28.5	28.5		10.6	
Effective Green, g (s)	19.0	27.8		9.1	17.9	17.9	11.9	28.5	28.5		10.6	
Actuated g/C Ratio	0.23	0.33		0.11	0.21	0.21	0.14	0.34	0.34		0.13	
Clearance Time (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0		5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0		3.0	
Lane Grp Cap (vph)	782	1695		376	1091	598	469	1209	952		445	
v/s Ratio Prot	c0.15	0.07		0.04	c0.11		c0.07	0.08				
v/s Ratio Perm						0.10			0.05		c0.05	
v/c Ratio	0.65	0.20		0.34	0.49	0.48	0.49	0.23	0.14		0.40	
Uniform Delay, d1	29.2	19.0		34.4	28.8	28.7	32.9	19.5	19.0		33.5	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00		1.00	
Incremental Delay, d2	1.8	0.1		0.6	0.4	0.6	0.7	0.1	0.1		0.5	
Delay (s)	31.0	19.0		34.9	29.1	29.3	33.6	19.7	19.0		34.0	
Level of Service	C	B		C	C	C	C	B	B		C	
Approach Delay (s)		26.6			29.9			23.1			34.0	
Approach LOS		C			C			C			C	

Intersection Summary				
HCM Average Control Delay	27.1	HCM Level of Service	C	
HCM Volume to Capacity ratio	0.62			
Actuated Cycle Length (s)	83.4	Sum of lost time (s)	24.0	
Intersection Capacity Utilization	53.6%	ICU Level of Service	A	
Analysis Period (min)	15			
c Critical Lane Group				

HCM Unsignalized Intersection Capacity Analysis Total 2015 without NS extension with project
36: Roosevelt Avenue & West Entrance AM Peak Hour

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	3	308	691	4	2	1
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	3	335	751	4	2	1
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)			803			
pX, platoon unblocked	0.63				0.63	0.63
vC, conflicting volume	755				1092	751
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	317				652	319
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				99	100
cM capacity (veh/h)	782				207	460

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1	SB 2
Volume Total	3	335	751	4	2	1
Volume Left	3	0	0	0	2	0
Volume Right	0	0	0	4	0	1
cSH	782	1700	1700	1700	207	460
Volume to Capacity	0.00	0.20	0.44	0.00	0.01	0.00
Queue Length 95th (ft)	0	0	0	0	1	0
Control Delay (s)	9.6	0.0	0.0	0.0	22.6	12.6
Lane LOS	A				C	B
Approach Delay (s)	0.1		0.0		19.4	
Approach LOS					C	

Intersection Summary			
Average Delay	0.1		
Intersection Capacity Utilization	46.1%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Signalized Intersection Capacity Analysis Total 2015 without NS extension with project
39: Roosevelt Avenue & East Entrance AM Peak Hour

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	27	310	666	34	15	13
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0	6.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	1.00	0.85	1.00	0.85
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1770	1863	1863	1583	1770	1583
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1770	1863	1863	1583	1770	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	29	337	755	37	18	14
RTOR Reduction (vph)	0	0	0	18	0	12
Lane Group Flow (vph)	29	337	755	19	16	2
Turn Type	Prot			Perm		Perm
Protected Phases	7	4	8		6	
Permitted Phases				8		6
Actuated Green, G (s)	2.2	38.0	29.8	29.8	6.8	6.8
Effective Green, g (s)	2.2	38.0	29.8	29.8	6.8	6.8
Actuated g/C Ratio	0.04	0.67	0.52	0.52	0.12	0.12
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	59	1246	977	831	212	196
v/s Ratio Prot	0.02	c0.18	c0.41		c0.01	
v/s Ratio Perm				0.01		0.00
v/c Ratio	0.42	0.27	0.77	0.02	0.08	0.01
Uniform Delay, d1	26.7	3.8	10.8	6.5	22.2	22.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	4.1	0.1	3.8	0.0	0.2	0.0
Delay (s)	30.8	3.9	14.8	6.5	22.4	22.0
Level of Service	C	A	B	A	C	C
Approach Delay (s)		6.0	14.3		22.2	
Approach LOS		A	B		C	

Intersection Summary			
HCM Average Control Delay	11.9	HCM Level of Service	B
HCM Volume to Capacity ratio	0.66		
Actuated Cycle Length (s)	56.8	Sum of lost time (s)	18.0
Intersection Capacity Utilization	46.9%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis Total 2015 without NS extension with project
7: Kapolei Parkway & Kamasha Avenue PM Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	38	640	33	115	665	223	21	71	57	123	77	22
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0		6.0	6.0		5.0	5.0		5.0	5.0	
Lane Util. Factor	1.00	0.91		1.00	0.91		1.00	1.00		1.00	1.00	
Frt	1.00	0.99		1.00	0.99		1.00	0.93		1.00	0.97	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	5048		1770	4894		1770	1738		1770	1801	
Flt Permitted	0.95	1.00		0.95	1.00		0.69	1.00		0.95	1.00	
Satd. Flow (perm)	1770	5048		1770	4894		1280	1738		1770	1801	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	41	696	36	125	723	242	23	77	62	134	84	24
RTOR Reduction (vph)	0	4	0	0	40	0	0	21	0	0	5	0
Lane Group Flow (vph)	41	728	0	125	925	0	23	118	0	134	103	0
Turn Type	Prot			Prot			Perm			Prot		
Protected Phases	7	4		3	8			2		1	5	
Permitted Phases							2					
Actuated Green, G (s)	4.7	23.0		11.9	30.2		11.8	11.8		12.3	25.1	
Effective Green, g (s)	4.7	23.0		11.9	30.2		11.8	11.8		12.3	25.1	
Actuated g/C Ratio	0.06	0.26		0.16	0.37		0.15	0.15		0.15	0.35	
Clearance Time (s)	6.0	6.0		6.0	6.0		5.0	5.0		5.0	5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	103	1433		250	1825		198	263		269	647	
v/s Ratio Prot	0.02	0.14		c0.07	c0.19			c0.07		c0.08	0.06	
v/s Ratio Perm							0.02					
v/c Ratio	0.40	0.51		0.48	0.51		0.12	0.47		0.50	0.16	
Uniform Delay, d1	36.6	24.3		31.7	19.8		30.1	31.7		31.5	17.6	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	2.5	0.3		1.4	0.2		0.3	1.4		1.5	0.1	
Delay (s)	39.3	24.6		33.1	19.9		30.4	33.1		33.0	17.7	
Level of Service	D	C		C	B		C	C		C	B	
Approach Delay (s)		25.3			21.4			32.7			26.2	
Approach LOS		C			C			C			C	

Intersection Summary			
HCM Average Control Delay	24.1	HCM Level of Service	C
HCM Volume to Capacity ratio	0.52		
Actuated Cycle Length (s)	81.0	Sum of lost time (s)	22.0
Intersection Capacity Utilization	53.5%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis Total 2015 without NS extension with project
10: Kapolei Parkway & Kinoiki Street PM Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	72	415	336	119	524	101	420	130	314	106	113	55
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Lane Util. Factor	1.00	0.91	1.00	0.97	0.91	1.00	0.97	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	5086	1585	3433	5086	1583	3433	1863	1583	1770	1863	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	5086	1585	3433	5086	1583	3433	1863	1583	1770	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	78	451	367	129	570	110	457	141	341	115	123	60
RTOR Reduction (vph)	0	0	280	0	0	83	0	0	268	0	0	51
Lane Group Flow (vph)	78	451	87	129	570	27	457	141	73	115	123	9
Turn Type	Prot		Perm	Prot		Perm	Prot		Perm	Prot		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8			2			6
Actuated Green, G (s)	7.9	19.0	19.0	9.0	20.1	20.1	17.0	17.2	17.2	11.3	11.5	11.5
Effective Green, g (s)	7.9	19.0	19.0	9.0	20.1	20.1	17.0	17.2	17.2	11.3	11.5	11.5
Actuated g/C Ratio	0.10	0.24	0.24	0.11	0.25	0.25	0.21	0.21	0.21	0.14	0.14	0.14
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	174	1200	374	384	1270	395	726	398	338	248	266	226
v/s Ratio Prot	c0.04	0.09		0.04	c0.11		c0.13	c0.08		0.06	c0.07	
v/s Ratio Perm			0.05			0.02			0.05			0.01
v/c Ratio	0.45	0.38	0.23	0.34	0.45	0.07	0.63	0.35	0.22	0.46	0.46	0.04
Uniform Delay, d1	34.2	25.8	24.9	33.0	25.6	23.1	28.9	25.9	26.1	31.8	31.7	29.7
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.8	0.2	0.3	0.6	0.3	0.1	1.8	0.5	0.3	1.4	1.3	0.1
Delay (s)	36.1	26.0	25.2	33.6	25.8	23.1	30.7	27.5	26.4	33.2	32.9	29.8
Level of Service	D	C	C	C	C	C	C	C	C	C	C	C
Approach Delay (s)		26.5			26.6			28.6			32.4	
Approach LOS		C			C			C			C	

Intersection Summary				
HCM Average Control Delay	27.8	HCM Level of Service	C	
HCM Volume to Capacity ratio	0.50			
Actuated Cycle Length (s)	80.5	Sum of lost time (s)	24.0	
Intersection Capacity Utilization	62.0%	ICU Level of Service	A	
Analysis Period (min)	15			
c Critical Lane Group				

HCM Signalized Intersection Capacity Analysis Total 2015 without NS extension with project
13: Kapolei Parkway & Renton Road PM Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SWL	SWT	SWR
Lane Configurations												
Volume (vph)	191	723	16	27	664	114	19	136	73	141	73	159
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0		6.0	6.0		5.0	5.0		5.0	5.0	5.0
Lane Util. Factor	1.00	0.91		1.00	0.91		1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00		1.00	0.97		1.00	0.95		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	5069		1770	4955		1770	1786		1770	1863	1583
Flt Permitted	0.95	1.00		0.95	1.00		0.71	1.00		0.52	1.00	1.00
Satd. Flow (perm)	1770	5069		1770	4955		1314	1786		963	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	208	786	17	29	602	124	21	148	79	153	79	172
RTOR Reduction (vph)	0	2	0	0	21	0	0	14	0	0	0	128
Lane Group Flow (vph)	208	801	0	29	705	0	21	213	0	153	79	44
Turn Type	Prot			Prot			Perm			Perm		Perm
Protected Phases	7	4		3	8			2			6	
Permitted Phases							2			6		6
Actuated Green, G (s)	16.3	36.6		2.5	23.8		19.1	19.1		19.1	19.1	19.1
Effective Green, g (s)	16.3	36.6		2.5	23.8		19.1	19.1		19.1	19.1	19.1
Actuated g/C Ratio	0.20	0.49		0.03	0.32		0.25	0.25		0.25	0.25	0.25
Clearance Time (s)	6.0	6.0		6.0	6.0		5.0	5.0		5.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	360	2457		59	1588		334	449		246	473	402
v/s Ratio Prot	c0.12	0.16		0.02	c0.14			0.12			0.04	
v/s Ratio Perm							0.02			c0.16		0.03
v/c Ratio	0.58	0.32		0.49	0.45		0.06	0.47		0.62	0.17	0.11
Uniform Delay, d1	27.0	11.8		35.7	20.5		21.3	23.6		24.9	21.6	21.5
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	2.2	0.1		6.3	0.2		0.1	0.8		4.9	0.2	0.1
Delay (s)	29.3	11.8		42.0	20.7		21.3	24.6		29.8	22.0	21.6
Level of Service	C	B		D	C		C	C		C	C	C
Approach Delay (s)		15.4			21.5			24.3			24.8	
Approach LOS		B			C			C			C	

Intersection Summary				
HCM Average Control Delay	19.8	HCM Level of Service	B	
HCM Volume to Capacity ratio	0.54			
Actuated Cycle Length (s)	75.2	Sum of lost time (s)	17.0	
Intersection Capacity Utilization	61.8%	ICU Level of Service	B	
Analysis Period (min)	15			
c Critical Lane Group				

HCM Signalized Intersection Capacity Analysis Total 2015 without NS extension with project
28: Kapolei Parkway & Kualakai Parkway PM Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	SBL	SBT	SBR	NWL	NWT	NWR
Lane Configurations												
Volume (vph)	378	463	9	229	209	265	357	519	461	19	491	127
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0		6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	
Lane Util. Factor	0.97	0.91		0.97	0.91	0.88	0.97	0.95	0.88	1.00	0.95	
Frt	1.00	1.00		1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.97	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	3433	5073		3433	5085	2787	3433	5036	2787	1770	3430	
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	3433	5073		3433	5085	2787	3433	5036	2787	1770	3430	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	411	402	10	249	292	299	388	564	501	21	534	138
RTOR Reduction (vph)	0	2	0	0	0	0	0	0	296	0	18	0
Lane Group Flow (vph)	411	510	0	249	292	299	388	564	215	21	656	0
Turn Type	Prot			Prot		Perm	Prot		Perm	Prot		
Protected Phases	7	4		3	8		1	6		5		
Permitted Phases						8			6		2	
Actuated Green, G (s)	19.1	23.7		13.8	18.2	18.2	18.0	48.1	48.1	2.8	32.9	
Effective Green, g (s)	19.1	23.7		13.8	18.2	18.2	18.0	48.1	48.1	2.8	32.9	
Actuated g/C Ratio	0.17	0.21		0.12	0.16	0.16	0.16	0.43	0.43	0.02	0.29	
Clearance Time (s)	6.0	6.0		6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	584	1071		416	825	462	561	1517	1195	44	1006	
v/s Ratio Prot	c0.12	c0.10		0.07	0.06		c0.11	0.16		0.01		
v/s Ratio Perm						c0.10			0.08		c0.19	
v/c Ratio	0.70	0.47		0.60	0.35	0.64	0.70	0.37	0.18	0.48	0.65	
Uniform Delay, d1	43.9	38.7		46.7	41.8	43.6	44.6	21.8	16.8	54.0	34.6	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	3.8	0.3		2.3	0.3	3.0	4.1	0.2	0.1	7.9	1.5	
Delay (s)	47.7	39.0		49.0	42.0	46.5	48.7	21.9	16.9	61.9	36.2	
Level of Service	D	D		D	D	D	D	C	B	E	D	
Approach Delay (s)		43.0			46.8			28.4			37.0	
Approach LOS		D			D			C			D	

Intersection Summary				
HCM Average Control Delay	37.1	HCM Level of Service	D	
HCM Volume to Capacity ratio	0.72			
Actuated Cycle Length (s)	112.2	Sum of lost time (s)	30.0	
Intersection Capacity Utilization	63.8%	ICU Level of Service	B	
Analysis Period (min)	15			
c Critical Lane Group				

HCM Unsignalized Intersection Capacity Analysis Total 2015 without NS extension with project
35: Roosevelt Avenue & West Entrance PM Peak Hour

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	5	700	648	6	7	6
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	5	830	487	7	8	7
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)			564			
pX, platoon unblocked	0.82				0.82	0.82
vC, conflicting volume	493				1333	497
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	286				1295	258
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	99				95	99
cM capacity (veh/h)	1069				145	537

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1	SB 2
Volume Total	5	835	487	7	8	7
Volume Left	5	0	0	0	8	0
Volume Right	0	0	0	7	0	7
cSH	1069	1700	1700	1700	145	537
Volume to Capacity	0.01	0.49	0.29	0.00	0.05	0.01
Queue Length 95th (ft)	0	0	0	0	4	1
Control Delay (s)	8.4	0.0	0.0	0.0	31.1	10.7
Lane LOS	A				D	B
Approach Delay (s)	0.1		0.0		21.7	
Approach LOS					C	

Intersection Summary				
Average Delay	0.3			
Intersection Capacity Utilization	50.4%	ICU Level of Service		A
Analysis Period (min)	15			

HCM Signalized Intersection Capacity Analysis Total 2015 without NS extension with project
39: Roosevelt Avenue & East Entrance PM Peak Hour

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	116	776	464	87	126	84
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0	6.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	1.00	0.85	1.00	0.85
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1770	1863	1863	1583	1770	1583
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1770	1863	1863	1583	1770	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	126	843	493	95	139	91
RTOR Reduction (vph)	0	0	0	68	0	75
Lane Group Flow (vph)	126	843	493	27	139	16
Turn Type	Prot			Perm		Perm
Protected Phases	7	4	8		6	
Permitted Phases				8		6
Actuated Green, G (s)	11.0	43.4	26.4	26.4	11.6	11.6
Effective Green, g (s)	11.0	43.4	26.4	26.4	11.6	11.6
Actuated g/C Ratio	0.16	0.65	0.39	0.39	0.17	0.17
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	291	1207	734	624	306	274
v/s Ratio Prot	0.07	c0.46	0.26		c0.08	
v/s Ratio Perm				0.02		0.01
v/c Ratio	0.43	0.70	0.67	0.04	0.45	0.06
Uniform Delay, d1	25.2	7.6	16.7	12.6	24.9	23.1
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.0	1.8	2.4	0.0	1.1	0.1
Delay (s)	26.2	9.4	19.2	12.6	25.9	23.2
Level of Service	C	A	B	B	C	C
Approach Delay (s)		11.5	18.1		24.9	
Approach LOS		B	B		C	

Intersection Summary				
HCM Average Control Delay	15.4	HCM Level of Service		B
HCM Volume to Capacity ratio	0.65			
Actuated Cycle Length (s)	67.0	Sum of lost time (s)		12.0
Intersection Capacity Utilization	57.9%	ICU Level of Service		B
Analysis Period (min)	15			
c Critical Lane Group				

HCM Signalized Intersection Capacity Analysis Total 2015 with NS extension with project
7: Kapolei Parkway & Kamasha Avenue AM Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	83	471	101	165	461	143	107	241	154	161	211	83
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0		6.0	6.0		5.0	5.0		5.0	5.0	
Lane Util. Factor	1.00	0.91		1.00	0.91		1.00	1.00		1.00	1.00	
Frt	1.00	0.97		1.00	0.97		1.00	0.94		1.00	0.96	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	4859		1770	4918		1770	1750		1770	1794	
Flt Permitted	0.55	1.00		0.95	1.00		0.57	1.00		0.95	1.00	
Satd. Flow (perm)	1770	4859		1770	4918		1056	1750		1770	1794	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	90	512	110	179	501	155	116	262	167	175	229	90
RTOR Reduction (vph)	0	21	0	0	31	0	0	19	0	0	12	0
Lane Group Flow (vph)	90	601	0	179	625	0	116	410	0	175	307	0
Turn Type	Prot			Prot			Perm			Prot		
Protected Phases	7	4		3	8			2		1	6	
Permitted Phases							2					
Actuated Green, G (s)	9.2	20.9		12.7	24.4		32.2	32.2		18.1	53.3	
Effective Green, g (s)	9.2	20.9		12.7	24.4		32.2	32.2		18.1	53.3	
Actuated g/C Ratio	0.09	0.20		0.12	0.23		0.31	0.31		0.16	0.51	
Clearance Time (s)	6.0	6.0		6.0	6.0		5.0	5.0		5.0	5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	157	998		216	1154		327	542		274	915	
v/s Ratio Prot	0.05	0.12		c0.07	c0.13			c0.24		c0.10	0.17	
v/s Ratio Perm							0.11					
v/c Ratio	0.57	0.60		0.54	0.57		0.35	0.76		0.64	0.34	
Uniform Delay, d1	46.5	37.7		42.9	35.1		27.8	32.6		41.2	14.9	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	5.0	1.0		2.8	0.6		0.7	6.9		4.8	0.2	
Delay (s)	60.4	38.8		45.6	35.7		28.5	39.5		46.0	15.1	
Level of Service	D	D		D	D		C	D		D	B	
Approach Delay (s)		40.2			37.2			37.2			26.0	
Approach LOS		D			D			D			C	

Intersection Summary				
HCM Average Control Delay	36.9	HCM Level of Service		D
HCM Volume to Capacity ratio	0.68			
Actuated Cycle Length (s)	103.9	Sum of lost time (s)		22.0
Intersection Capacity Utilization	67.3%	ICU Level of Service		C
Analysis Period (min)	15			
c Critical Lane Group				

HCM Signalized Intersection Capacity Analysis — Total 2015 with NS extension with project
10: Kapolei Parkway & Kinoiki Street — AM Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	87	527	181	65	620	102	82	31	69	136	68	96
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	5.0	6.0	6.0	5.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Lane Util. Factor	1.00	0.91	1.00	0.97	0.91	1.00	0.97	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	5085	1583	3433	5085	1583	3433	1863	1583	1770	1863	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	5085	1583	3433	5085	1583	3433	1863	1583	1770	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	95	573	197	71	674	111	89	34	75	148	74	107
RTOR Reduction (vph)	0	0	140	0	0	83	0	0	65	0	0	84
Lane Group Flow (vph)	95	573	57	71	674	28	89	34	10	148	74	23
Turn Type	Prot		Perm	Prot		Perm	Prot		Perm	Prot		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8			2			6
Actuated Green, G (s)	7.9	20.6	20.6	5.6	18.3	18.3	6.0	9.3	9.3	12.3	15.6	15.6
Effective Green, g (s)	7.9	20.6	20.6	5.6	18.3	18.3	6.0	9.3	9.3	12.3	15.6	15.6
Actuated g/C Ratio	0.11	0.29	0.29	0.08	0.25	0.25	0.08	0.13	0.13	0.17	0.22	0.22
Clearance Time (s)	6.0	5.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	195	1459	454	268	1296	403	287	241	205	303	405	344
v/s Ratio Prot	c0.05	0.11		0.02	c0.13		0.03	0.02		c0.08	c0.04	
v/s Ratio Perm			0.04			0.02			0.01			0.01
v/c Ratio	0.49	0.39	0.12	0.26	0.52	0.07	0.31	0.14	0.05	0.49	0.18	0.07
Uniform Delay, d1	30.0	20.6	18.9	31.2	23.0	20.3	31.0	27.7	27.4	26.9	22.9	22.3
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.9	0.2	0.1	0.5	0.4	0.1	0.5	0.3	0.1	1.2	0.2	0.1
Delay (s)	32.0	20.7	19.1	31.7	23.4	20.4	31.6	28.0	27.5	28.1	23.1	22.4
Level of Service	C	C	B	C	C	C	C	C	C	C	C	C
Approach Delay (s)		21.6			23.7			29.4			25.1	
Approach LOS		C			C			C			C	

Intersection Summary				
HCM Average Control Delay	23.6	HCM Level of Service	C	
HCM Volume to Capacity ratio	0.40			
Actuated Cycle Length (s)	71.5	Sum of lost time (s)	18.0	
Intersection Capacity Utilization	48.0%	ICU Level of Service	A	
Analysis Period (min)	15			
c Critical Lane Group				

HCM Signalized Intersection Capacity Analysis — Total 2015 with NS extension with project
13: Kapolei Parkway & Renton Road — AM Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SWL	SWT	SWR
Lane Configurations												
Volume (vph)	141	367	15	57	632	377	12	71	19	271	129	202
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0		6.0	6.0		6.0	5.0		6.0	5.0	5.0
Lane Util. Factor	1.00	0.91		1.00	0.91		1.00	1.00		1.00	1.00	1.00
Frt	1.00	0.99		1.00	0.94		1.00	0.97		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	5064		1770	4800		1770	1803		1770	1863	1583
Flt Permitted	0.95	1.00		0.95	1.00		0.66	1.00		0.69	1.00	1.00
Satd. Flow (perm)	1770	5064		1770	4800		1225	1803		1292	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	153	399	17	62	687	410	13	77	21	295	140	220
RTOR Reduction (vph)	0	3	0	0	76	0	0	7	0	0	0	151
Lane Group Flow (vph)	153	413	0	62	1021	0	13	91	0	295	140	69
Turn Type	Prot			Prot			Perm			Perm		Perm
Protected Phases	7	4		3	8			2			6	
Permitted Phases							2			6		6
Actuated Green, G (s)	14.4	40.5		7.2	33.3		29.7	29.7		29.7	29.7	29.7
Effective Green, g (s)	14.4	40.5		7.2	33.3		29.7	29.7		29.7	29.7	29.7
Actuated g/C Ratio	0.15	0.43		0.08	0.35		0.31	0.31		0.31	0.31	0.31
Clearance Time (s)	6.0	6.0		6.0	6.0		5.0	5.0		5.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	270	2168		135	1693		385	567		406	586	498
v/s Ratio Prot	c0.09	0.08		0.04	c0.21						0.08	
v/s Ratio Perm							0.01			c0.23		0.04
v/c Ratio	0.57	0.19		0.46	0.60		0.03	0.16		0.73	0.24	0.14
Uniform Delay, d1	37.1	16.8		41.7	25.1		22.4	23.4		28.7	24.0	23.2
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	2.7	0.0		2.5	0.6		0.0	0.1		6.4	0.2	0.1
Delay (s)	39.8	16.8		44.2	25.7		22.4	23.5		35.1	24.2	23.3
Level of Service	D	B		D	C		C	C		D	C	C
Approach Delay (s)		23.0			28.7			23.4			28.8	
Approach LOS		C			C			C			C	

Intersection Summary				
HCM Average Control Delay	26.3	HCM Level of Service	C	
HCM Volume to Capacity ratio	0.64			
Actuated Cycle Length (s)	94.4	Sum of lost time (s)	17.0	
Intersection Capacity Utilization	64.3%	ICU Level of Service	C	
Analysis Period (min)	15			
c Critical Lane Group				

Movement	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Volume (vph)	466	289	27	163	446	267	195	305	322	60	215	62
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0		6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	
Lane Util. Factor	0.97	0.91		0.97	0.91	0.88	0.97	0.95	0.88	1.00	0.95	
Frt	1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.97	
Flt Protected	0.95	1.00		0.95	1.00	1.00	1.00	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	3433	5021		3433	5085	2787	3433	3539	2787	1770	3421	
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	3433	5021		3433	5085	2787	3433	3539	2787	1770	3421	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	507	314	29	177	485	290	212	335	350	54	234	67
RTOR Reduction (vph)	0	8	0	0	0	0	0	0	271	0	18	0
Lane Group Flow (vph)	507	335	0	177	485	290	212	335	79	54	283	0
Turn Type	Prot			Prot		Perm	Prot		Perm	Prot		
Protected Phases	7	4		3	8		1	6		5		
Permitted Phases						8			6		2	
Actuated Green, G (s)	19.5	26.8		10.8	17.9	17.9	11.5	20.0	20.0	7.0	15.4	
Effective Green, g (s)	19.5	26.8		10.5	17.9	17.9	11.8	20.0	20.0	7.0	15.4	
Actuated g/C Ratio	0.22	0.30		0.12	0.20	0.20	0.13	0.23	0.23	0.08	0.17	
Clearance Time (s)	6.0	6.0		6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	757	1522		412	1030	564	450	901	631	140	596	
v/s Ratio Prot	c0.15	0.07		0.05	0.10		c0.06	c0.09		0.03		
v/s Ratio Perm						c0.10			0.03		0.08	
v/c Ratio	0.67	0.22		0.43	0.47	0.51	0.47	0.42	0.13	0.39	0.47	
Uniform Delay, d1	31.5	23.0		36.1	31.1	31.4	35.6	29.2	27.2	38.7	32.9	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	2.3	0.1		0.7	0.3	0.6	0.8	0.4	0.1	1.8	0.6	
Delay (s)	33.8	23.1		36.8	31.4	32.2	36.3	29.6	27.3	40.4	33.6	
Level of Service	C	C		D	C	C	D	C	C	D	C	
Approach Delay (s)		29.4			32.7			30.3			34.5	
Approach LOS		C			C			C			C	

Intersection Summary				
HCM Average Control Delay	31.3	HCM Level of Service	C	
HCM Volume to Capacity ratio	0.55			
Actuated Cycle Length (s)	88.4	Sum of lost time (s)	24.0	
Intersection Capacity Utilization	65.4%	ICU Level of Service	B	
Analysis Period (min)	15			
c Critical Lane Group				

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	2	370	754	2	1	1
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	2	402	820	2	1	1
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)			564			
pX, platoon unblocked	0.58				0.56	0.56
vC, conflicting volume	822				1226	820
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	295				1013	291
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				99	100
cM capacity (veh/h)	713				148	421

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1	SB 2
Volume Total	2	402	820	2	1	1
Volume Left	2	0	0	0	1	0
Volume Right	0	0	0	2	0	1
cSH	713	1700	1700	1700	148	421
Volume to Capacity	0.00	0.24	0.48	0.00	0.01	0.00
Queue Length 95th (ft)	0	0	0	0	1	0
Control Delay (s)	10.1	0.0	0.0	0.0	29.4	13.6
Lane LOS	B				D	B
Approach Delay (s)	0.1		0.0		21.5	
Approach LOS					C	

Intersection Summary				
Average Delay	0.1			
Intersection Capacity Utilization	49.7%	ICU Level of Service	A	
Analysis Period (min)	15			

Movement	EBL	EBT	WBT	WBR	SEL	SER
Lane Configurations						
Volume (vph)	77	321	719	157	67	70
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0	6.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	1.00	0.85	1.00	0.85
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1770	1863	1863	1583	1770	1583
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1770	1863	1863	1583	1770	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	84	349	772	171	73	76
RTOR Reduction (vph)	0	0	0	78	0	67
Lane Group Flow (vph)	84	349	772	93	73	9
Turn Type	Prot			Perm		Perm
Protected Phases	7	4	8		6	
Permitted Phases				8		6
Actuated Green, G (s)	7.8	66.2	42.4	42.4	9.6	9.6
Effective Green, g (s)	7.8	66.2	42.4	42.4	9.6	9.6
Actuated g/C Ratio	0.10	0.72	0.54	0.54	0.12	0.12
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	177	1346	1015	883	218	186
v/s Ratio Prot	c0.05	0.19	c0.41		c0.04	
v/s Ratio Perm				0.06		0.01
v/c Ratio	0.47	0.26	0.76	0.11	0.33	0.05
Uniform Delay, d1	33.1	3.7	13.8	8.6	31.2	30.1
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	2.0	0.1	3.4	0.1	0.9	0.1
Delay (s)	35.1	3.8	17.2	8.6	32.1	30.2
Level of Service	D	A	B	A	C	C
Approach Delay (s)		9.9	15.6		31.1	
Approach LOS		A	B		C	

Intersection Summary			
HCM Average Control Delay	15.5	HCM Level of Service	B
HCM Volume to Capacity ratio	0.65		
Actuated Cycle Length (s)	77.5	Sum of lost time (s)	18.0
Intersection Capacity Utilization	60.3%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	16	371	756	19	12	6
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0	6.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	1.00	0.86	1.00	0.85
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1770	1863	1863	1583	1770	1583
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1770	1863	1863	1583	1770	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	16	403	822	21	13	7
RTOR Reduction (vph)	0	0	0	10	0	6
Lane Group Flow (vph)	16	403	822	11	13	1
Turn Type	Prot			Perm		Perm
Protected Phases	7	4	8		6	
Permitted Phases				8		6
Actuated Green, G (s)	0.9	37.7	30.8	30.8	6.6	6.6
Effective Green, g (s)	0.9	37.7	30.8	30.8	6.6	6.6
Actuated g/C Ratio	0.02	0.67	0.55	0.55	0.12	0.12
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	29	1248	1019	868	207	186
v/s Ratio Prot	0.01	c0.22	c0.44		c0.01	
v/s Ratio Perm				0.01		0.00
v/c Ratio	0.57	0.32	0.81	0.01	0.06	0.00
Uniform Delay, d1	27.5	3.9	10.3	5.8	22.1	21.9
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	25.2	0.2	4.8	0.0	0.1	0.0
Delay (s)	52.7	4.1	15.1	5.8	22.2	22.0
Level of Service	D	A	B	A	C	C
Approach Delay (s)		5.9	14.9		22.1	
Approach LOS		A	B		C	

Intersection Summary			
HCM Average Control Delay	12.1	HCM Level of Service	B
HCM Volume to Capacity ratio	0.70		
Actuated Cycle Length (s)	55.3	Sum of lost time (s)	18.0
Intersection Capacity Utilization	53.1%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis — Total 2015 with NS extension with project
41: Kualakai Entrance & Kualakai Parkway — AM Peak Hour

Movement	EBL	EBR	SET	SER	NWL	NWT
Lane Configurations						
Volume (vph)	127	16	126	372	34	200
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0	6.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.86	1.00	0.86	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1770	1583	1863	1583	1770	1863
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1770	1583	1863	1583	1770	1863
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	138	17	137	404	37	217
RTOR Reduction (vph)	0	14	0	260	0	0
Lane Group Flow (vph)	138	3	137	164	37	217
Turn Type		Perm		Perm	Prot	
Protected Phases	4		6		5	2
Permitted Phases		4		6		
Actuated Green, G (s)	7.3	7.3	17.1	17.1	2.4	26.5
Effective Green, g (s)	7.3	7.3	17.1	17.1	2.4	26.5
Actuated g/C Ratio	0.16	0.16	0.38	0.38	0.05	0.57
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	288	258	711	604	95	1060
v/s Ratio Prot	c0.08		0.07		0.02	c0.12
v/s Ratio Perm		0.00		c0.10		
v/c Ratio	0.48	0.01	0.19	0.26	0.39	0.20
Uniform Delay, d1	17.0	15.7	9.2	9.5	20.5	4.7
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.3	0.0	0.1	0.2	2.6	0.1
Delay (s)	18.3	15.7	9.4	9.7	23.1	4.8
Level of Service	B	B	A	A	C	A
Approach Delay (s)	18.0		9.6			7.5
Approach LOS	B		A			A

Intersection Summary			
HCM Average Control Delay	10.4	HCM Level of Service	B
HCM Volume to Capacity ratio	0.34		
Actuated Cycle Length (s)	44.8	Sum of lost time (s)	18.0
Intersection Capacity Utilization	38.4%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis — Total 2015 with NS Extension with project
7: Kapolei Parkway & Kamaaha Avenue — PM Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	38	613	33	115	660	223	21	71	57	123	77	22
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Lane Util. Factor	1.00	0.91		1.00	0.91		1.00	1.00		1.00	1.00	
Frt	1.00	0.98		1.00	0.96		1.00	0.93		1.00	0.97	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	5046		1770	4893		1770	1735		1770	1801	
Flt Permitted	0.95	1.00		0.95	1.00		0.65	1.00		0.95	1.00	
Satd. Flow (perm)	1770	5046		1770	4893		1260	1735		1770	1801	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	41	666	36	125	717	242	23	77	62	134	84	24
RTOR Reduction (vph)	0	4	0	0	46	0	0	30	0	0	5	0
Lane Group Flow (vph)	41	698	0	125	913	0	23	119	0	134	103	0
Turn Type	Prot			Prot			Perm			Prot		
Protected Phases	7	4		3	8			2		1	6	
Permitted Phases							2					
Actuated Green, G (s)	4.7	22.6		11.8	29.7		11.8	11.8		12.2	29.0	
Effective Green, g (s)	4.7	22.6		11.8	29.7		11.8	11.8		12.2	29.0	
Actuated g/C Ratio	0.06	0.26		0.15	0.37		0.15	0.15		0.15	0.36	
Clearance Time (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	103	1418		260	1807		188	265		259	650	
v/s Ratio Prot	0.02	0.14		c0.07	c0.19			c0.07		c0.08	0.05	
v/s Ratio Perm							0.02					
v/c Ratio	0.40	0.49		0.48	0.51		0.12	0.46		0.50	0.15	
Uniform Delay, d1	36.5	24.1		31.5	19.7		26.8	31.4		31.3	17.4	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	2.6	0.3		1.4	0.2		0.3	1.3		1.5	0.1	
Delay (s)	39.0	24.4		32.9	19.9		30.1	32.7		32.7	17.5	
Level of Service	D	C		C	B		C	C		C	B	
Approach Delay (s)		25.2			21.4			32.4			25.9	
Approach LOS		C			C			C			C	

Intersection Summary			
HCM Average Control Delay	24.0	HCM Level of Service	C
HCM Volume to Capacity ratio	0.52		
Actuated Cycle Length (s)	80.4	Sum of lost time (s)	22.0
Intersection Capacity Utilization	53.4%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis — Total 2015 with NS Extension with project
10: Kapolei Parkway & Kinoiki Street — PM Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	72	388	336	119	524	101	429	130	314	106	113	55
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Lane Util. Factor	1.00	0.91	1.00	0.97	0.91	1.00	0.97	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	5085	1583	3433	5085	1583	3433	1883	1583	1770	1883	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	5085	1583	3433	5085	1583	3433	1883	1583	1770	1883	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	78	422	367	129	570	110	457	141	341	115	123	60
RTOR Reduction (vph)	0	0	281	0	0	83	0	0	268	0	0	51
Lane Group Flow (vph)	78	422	86	129	570	27	457	141	73	115	123	9
Turn Type	Prot		Perm	Prot		Perm	Prot		Perm	Prot		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8			2			6
Actuated Green, G (s)	7.9	18.9	18.9	9.0	20.0	20.0	17.0	17.2	17.2	11.3	11.5	11.5
Effective Green, g (s)	7.9	18.9	18.9	9.0	20.0	20.0	17.0	17.2	17.2	11.3	11.5	11.5
Actuated g/C Ratio	0.10	0.24	0.24	0.11	0.25	0.25	0.21	0.21	0.21	0.14	0.14	0.14
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	174	1195	372	384	1285	394	726	399	339	249	266	226
v/s Ratio Prot	c0.04	0.08		0.04	c0.11		c0.13	c0.08		0.06	c0.07	
v/s Ratio Perm			0.05			0.02			0.05			0.01
v/c Ratio	0.45	0.35	0.23	0.34	0.45	0.07	0.63	0.35	0.22	0.46	0.46	0.04
Uniform Delay, d1	34.2	25.7	24.9	32.9	25.6	23.1	28.8	26.9	25.0	31.8	31.8	29.7
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.6	0.2	0.3	0.5	0.3	0.1	1.7	0.5	0.3	1.4	1.3	0.1
Delay (s)	36.0	25.8	25.2	33.5	25.8	23.2	30.6	27.4	26.4	33.1	32.9	29.8
Level of Service	D	C	C	C	C	C	C	C	C	C	C	C
Approach Delay (s)		26.5			26.7			28.6			32.3	
Approach LOS		C			C			C			C	

Intersection Summary				
HCM Average Control Delay	27.8	HCM Level of Service		C
HCM Volume to Capacity ratio	0.50			
Actuated Cycle Length (s)	80.4	Sum of lost time (s)		24.0
Intersection Capacity Utilization	52.0%	ICU Level of Service		A
Analysis Period (min)	15			
c Critical Lane Group				

HCM Signalized Intersection Capacity Analysis — Total 2015 with NS Extension with project
13: Kapolei Parkway & Renton Road — PM Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SWL	SWT	SWR
Lane Configurations												
Volume (vph)	191	723	16	27	564	114	19	136	73	141	73	159
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0		6.0	6.0		5.0	5.0		5.0	5.0	5.0
Lane Util. Factor	1.00	0.91		1.00	0.91		1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00		1.00	0.97		1.00	0.95		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	5069		1770	4955		1770	1786		1770	1863	1583
Flt Permitted	0.95	1.00		0.95	1.00		0.71	1.00		0.52	1.00	1.00
Satd. Flow (perm)	1770	5069		1770	4955		1314	1786		963	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	208	786	17	29	602	124	21	148	79	153	79	172
RTOR Reduction (vph)	0	2	0	0	21	0	0	14	0	0	0	128
Lane Group Flow (vph)	208	801	0	29	705	0	21	213	0	153	79	44
Turn Type	Prot			Prot			Perm			Perm		Perm
Protected Phases	7	4		3	8			2			6	
Permitted Phases							2			6		6
Actuated Green, G (s)	16.3	36.6		2.5	23.8		19.1	19.1		19.1	19.1	19.1
Effective Green, g (s)	16.3	36.6		2.5	23.8		19.1	19.1		19.1	19.1	19.1
Actuated g/C Ratio	0.20	0.49		0.03	0.32		0.25	0.25		0.25	0.25	0.25
Clearance Time (s)	6.0	6.0		6.0	6.0		5.0	5.0		5.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	360	2457		59	1588		334	449		246	473	402
v/s Ratio Prot	c0.12	0.15		0.02	c0.14			0.12			0.04	
v/s Ratio Perm							0.02			c0.16		0.03
v/c Ratio	0.58	0.32		0.49	0.45		0.06	0.47		0.62	0.17	0.11
Uniform Delay, d1	27.0	11.8		35.7	20.5		21.3	23.6		24.6	21.9	21.5
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	2.2	0.1		6.3	0.2		0.1	0.8		4.9	0.2	0.1
Delay (s)	29.3	11.8		42.0	20.7		21.3	24.6		29.6	22.0	21.6
Level of Service	C	B		D	C		C	C		C	C	C
Approach Delay (s)		15.4			21.5			24.3			24.8	
Approach LOS		B			C			C			C	

Intersection Summary				
HCM Average Control Delay	19.8	HCM Level of Service		B
HCM Volume to Capacity ratio	0.54			
Actuated Cycle Length (s)	75.2	Sum of lost time (s)		17.0
Intersection Capacity Utilization	61.6%	ICU Level of Service		B
Analysis Period (min)	15			
c Critical Lane Group				

HCM Signalized Intersection Capacity Analysis — Total 2015 with NS Extension with project
28: Kapolei Parkway & Kualakai Parkway — PM Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	SBL	SBT	SBR	NWL	NWT	NWR
Lane Configurations												
Volume (vph)	378	426	36	256	242	266	317	602	418	84	622	193
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	
Lane Util. Factor	0.97	0.91		0.97	0.91	0.86	0.97	0.95	0.86	1.00	0.95	
Frt	1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.96	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	3433	5026		3433	5086	2787	3433	3539	2787	1770	3413	
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	3433	5026		3433	5086	2787	3433	3539	2787	1770	3413	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	411	463	39	278	263	289	345	654	454	91	676	210
RTOR Reduction (vph)	0	6	0	0	0	0	0	0	281	0	20	0
Lane Group Flow (vph)	411	496	0	278	263	289	345	654	173	91	866	0
Turn Type	Prot			Prot		Perm	Prot		Perm	Prot		
Protected Phases	7	4		3	8		1	5		5		
Permitted Phases						8			6		2	
Actuated Green, G (s)	20.3	24.4		14.7	18.8	18.8	17.6	45.5	45.5	10.9	38.8	
Effective Green, g (s)	20.3	24.4		14.7	18.8	18.8	17.6	45.5	45.5	10.9	38.8	
Actuated g/C Ratio	0.17	0.20		0.12	0.16	0.16	0.15	0.38	0.38	0.09	0.32	
Clearance Time (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	583	1026		422	800	438	506	1347	1061	161	1108	
v/s Ratio Prot	c0.12	c0.10		0.08	0.05		c0.10	0.18		0.05		
v/s Ratio Perm						c0.10			0.06		c0.25	
v/c Ratio	0.70	0.48		0.66	0.33	0.66	0.68	0.49	0.16	0.57	0.78	
Uniform Delay, d1	46.8	42.0		50.0	44.7	47.3	48.3	28.1	24.4	52.0	38.5	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	3.9	0.4		3.7	0.2	3.6	3.8	0.3	0.1	4.5	3.6	
Delay (s)	50.6	42.3		53.7	45.0	50.9	52.1	28.4	24.5	56.5	40.2	
Level of Service	D	D		D	D	D	D	C	C	E	D	
Approach Delay (s)		46.1			50.0			32.8			41.7	
Approach LOS		D			D			C			D	

Intersection Summary				
HCM Average Control Delay	41.2	HCM Level of Service	D	
HCM Volume to Capacity ratio	0.77			
Actuated Cycle Length (s)	119.5	Sum of lost time (s)	30.0	
Intersection Capacity Utilization	88.7%	ICU Level of Service	C	
Analysis Period (min)	15			
c Critical Lane Group				

HCM Unsignalized Intersection Capacity Analysis — Total 2015 with NS Extension with project
35: Roosevelt Avenue & West Entrance — PM Peak Hour

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	3	934	517	3	5	3
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	3	1015	562	3	5	3
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)			864			
pX, platoon unblocked	0.79				0.79	0.79
vC, conflicting volume	565				1584	562
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	315				1605	311
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				94	99
cM capacity (veh/h)	982				91	475

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1	SB 2
Volume Total	3	1015	562	3	5	3
Volume Left	3	0	0	0	5	0
Volume Right	0	0	0	3	0	3
cSH	982	1700	1700	1700	91	575
Volume to Capacity	0.00	0.60	0.33	0.00	0.06	0.01
Queue Length 95th (ft)	0	0	0	0	5	0
Control Delay (s)	8.7	0.0	0.0	0.0	47.1	11.3
Lane LOS	A				E	B
Approach Delay (s)	0.0		0.0		33.7	
Approach LOS					D	

Intersection Summary			
Average Delay	0.2		
Intersection Capacity Utilization	66.2%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	191	885	509	126	104	98
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0	6.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	1.00	0.85	1.00	0.85
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1770	1863	1863	1583	1770	1583
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1770	1863	1863	1583	1770	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	208	962	553	139	113	107
RTOR Reduction (vph)	0	0	0	81	0	91
Lane Group Flow (vph)	208	962	553	58	113	16
Turn Type	Prot			Perm		Perm
Protected Phases	7	4	8		6	
Permitted Phases				8		6
Actuated Green, G (s)	16.0	54.5	32.5	32.5	11.5	11.5
Effective Green, g (s)	16.0	54.5	32.5	32.5	11.5	11.5
Actuated g/C Ratio	0.21	0.70	0.42	0.42	0.15	0.15
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	363	1302	776	660	261	233
v/s Ratio Prot	0.12	c0.52	0.30		c0.06	
v/s Ratio Perm				0.04		0.01
v/c Ratio	0.57	0.74	0.71	0.09	0.43	0.07
Uniform Delay, d1	27.9	7.3	18.9	13.8	30.3	28.8
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	2.2	2.2	3.1	0.1	1.2	0.1
Delay (s)	30.1	9.6	22.0	13.8	31.4	28.8
Level of Service	C	A	C	B	C	C
Approach Delay (s)		13.2	20.3		30.1	
Approach LOS		B	C		C	

Intersection Summary				
HCM Average Control Delay	17.4	HCM Level of Service		B
HCM Volume to Capacity ratio	0.69			
Actuated Cycle Length (s)	78.0	Sum of lost time (s)		12.0
Intersection Capacity Utilization	62.3%	ICU Level of Service		B
Analysis Period (min)	15			
c Critical Lane Group				

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	82	939	520	58	112	58
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0	6.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	1.00	0.85	1.00	0.85
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1770	1863	1863	1583	1770	1583
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1770	1863	1863	1583	1770	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	89	1021	565	63	122	63
RTOR Reduction (vph)	0	0	0	32	0	53
Lane Group Flow (vph)	89	1021	565	31	122	10
Turn Type	Prot			Perm		Perm
Protected Phases	7	4	8		6	
Permitted Phases				8		6
Actuated Green, G (s)	7.8	50.1	35.3	35.3	11.2	11.2
Effective Green, g (s)	7.8	50.1	35.3	35.3	11.2	11.2
Actuated g/C Ratio	0.11	0.68	0.50	0.50	0.16	0.16
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	188	1273	923	784	270	242
v/s Ratio Prot	0.05	c0.55	0.30		c0.07	
v/s Ratio Perm				0.02		0.01
v/c Ratio	0.47	0.80	0.61	0.04	0.45	0.04
Uniform Delay, d1	30.8	8.1	13.4	9.6	28.3	26.6
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.9	3.7	1.2	0.0	1.2	0.1
Delay (s)	32.7	11.9	14.6	9.5	29.5	26.6
Level of Service	C	B	B	A	C	C
Approach Delay (s)		13.5	14.1		28.5	
Approach LOS		B	B		C	

Intersection Summary				
HCM Average Control Delay	15.2	HCM Level of Service		B
HCM Volume to Capacity ratio	0.74			
Actuated Cycle Length (s)	73.3	Sum of lost time (s)		12.0
Intersection Capacity Utilization	66.6%	ICU Level of Service		C
Analysis Period (min)	15			
c Critical Lane Group				

Movement	EBL	EBR	SET	SER	NWL	NWT
Lane Configurations						
Volume (vph)	542	47	137	522	57	262
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0	6.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1770	1583	1863	1583	1770	1863
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1770	1583	1863	1583	1770	1863
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	589	51	149	676	62	285
RTOR Reduction (vph)	0	24	0	512	0	0
Lane Group Flow (vph)	589	27	149	164	62	285
Turn Type		Perm		Perm	Prot	
Protected Phases	4		8		5	2
Permitted Phases		4		8		
Actuated Green, G (s)	30.7	30.7	17.7	17.7	6.7	30.4
Effective Green, g (s)	30.7	30.7	17.7	17.7	6.7	30.4
Actuated g/C Ratio	0.42	0.42	0.24	0.24	0.09	0.42
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	748	665	461	393	162	775
v/s Ratio Prot	c0.33		0.08		0.04	c0.15
v/s Ratio Perm		0.02		c0.10		
v/c Ratio	0.79	0.04	0.33	0.43	0.38	0.37
Uniform Delay, d1	18.4	12.5	22.8	23.4	31.3	14.7
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	5.8	0.0	0.4	0.8	1.5	0.3
Delay (s)	24.2	12.5	23.3	24.2	32.8	15.0
Level of Service	C	B	C	C	C	B
Approach Delay (s)	23.3		24.0			18.2
Approach LOS	C		C			B

Intersection Summary			
HCM Average Control Delay	22.7	HCM Level of Service	C
HCM Volume to Capacity ratio	0.65		
Actuated Cycle Length (s)	73.1	Sum of lost time (s)	18.0
Intersection Capacity Utilization	55.6%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Appendix C

Land Use Ordinance
BMX-3/BMX-4 Development Standards

TABLE 21-3
MASTER USE TABLE

In the event of any conflict between the text of this Chapter and the following table, the text of the Chapter shall control. The following table is not intended to cover the Waikiki Special District; please refer to Table 21-9.6(A).

KEY: Ac = Special accessory use subject to standards in Article 5
Cm = Conditional Use Permit-minor subject to standards in Article 5; no public hearing required (see Article 2 for exceptions)
C = Conditional Use Permit-major subject to standards in Article 5; public hearing required
P = Permitted use
P/c = Permitted use subject to standards in Article 5
PRU = Plan Review Use

USES (Note: Certain uses are defined in Article 10.1)	ZONING DISTRICTS																				
	P-2	AG-1	AG-2	Country	R-20, R-10	R-7.5, R-5, R-3.5	A-1	A-2	A-3	AMX-1	AMX-2	AMX-3	Resort	B-1	B-2	BMX-3	BMX-4	I-1	I-2	I-3	IMX-1
AGRICULTURE																					
Agribusiness activities		Cm	Cm																		
Agricultural products processing, minor		P/c	P/c															P/c	P/c		P/c
Agricultural products processing, major		C	C																P/c		
Animal products processing																			P	P	
Aquaculture	P	P	P	P																	
Centralized bulk collection, storage and distribution of agricultural products to wholesale and retail markets		P/c	P/c															P/c	P		
Composting, major	C	C	C																P/c		
Composting, minor	P/c	P/c	P/c																P/c		
Crop production	P	P	P	P																	
Forestry	P	P	P																		
Open land		P	P																		
Roadside stands, accessory		Ac	Ac	Ac																	
Sale and service of machinery used in agricultural production		P/c	P/c															P	P		P

TABLE 21-3
MASTER USE TABLE

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PRU = Plan Review Use

USES (Note: Certain uses are defined in Article 10.1)	ZONING DISTRICTS																				
	P-2	AG-1	AG-2	Country	R-20, R-10	R-7.5, R-5, R-3.5	A-1	A-2	A-3	AMX-1	AMX-2	AMX-3	Resort	B-1	B-2	BMX-3	BMX-4	I-1	I-2	I-3	IMX-1
Sawmills		P/c	P/c																P		
Storage and sale of seed, feed, fertilizer and other products essential to agricultural production		P/c	P/c															P	P		
ANIMALS																					
Game preserves	P		P																		
Kennels, commercial			P/c	P/c											P/c	P/c	P/c	P/c	P		P/c
Livestock grazing	P	P	P	P																	
Livestock production, minor		P	P	P																	
Livestock production, major		P/c	P/c																		
Livestock veterinary services		P	P	P																	
Zoos	C		C																		
COMMERCE AND BUSINESS																					
Amusement and recreation facilities, indoor	C												P	P[1]	P	P	P	P	P	P	P[2]
Automobile sales and rentals, including sales and distribution of automobile parts and supplies															P	P	P	P	P		P
Bars, nightclubs, taverns													P		P/c	P/c	P/c	P/c	P		P/c

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USES (Note: Certain uses are defined in Article 10.1)	ZONING DISTRICTS																				
	P-2	AG-1	AG-2	Country	R-20, R-10	R-7.5, R-5, R-3.5	A-1	A-2	A-3	AMX-1	AMX-2	AMX-3	Resort	B-1	B-2	BMX-3	BMX-4	I-1	I-2	I-3	IMX-1
Business services													P	P	P	P	P	P	P		P
Cabarets													P		P/c		P/c				P/c
Catering establishments													P		P	P	P	P	P		P
Convenience stores										P/c[1]	P/c[1]	P/c[1]	P	Cm P/c	P	P	P	P/c	P/c		P
Dance or music schools										P/c[1]	P/c[1]	P/c[1]	P/c	P	P	P	P				P[2]
Data processing facilities																		P	P		P
Drive-thru facilities														P/c	P/c	P/c	P/c	P/c	P/c	P/c	P/c
Eating establishments										P/c[1]	P/c[1]	P/c[1]	P	P	P	P	P	P	P	P	P
Financial institutions										P[1]	P[1]	P[1]	P	P	P	P	P	P	P		P
Home improvement centers															P/c	P/c		P	P		P
Home occupations		Ac	Ac	Ac	Ac	Ac	Ac	Ac	Ac	Ac	Ac	Ac	Ac			Ac	Ac				
Laboratories, medical														P	P	P	P	P	P		P
Laboratories, research															P	P	P	P	P		P
Medical clinics										P/c[1]	P/c[1]	P/c[1]	P	P	P	P	P				P[2]
Neighborhood grocery stores		Cm	Cm	Cm	Cm	Cm	Cm	Cm	Cm	Cm	Cm	Cm						Cm	Cm	Cm	
Office buildings														P	P	P	P				P[2]
Offices, accessory																		Ac	Ac	Ac	

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USES (Note: Certain uses are defined in Article 10.1)	ZONING DISTRICTS																				
	P-2	AG-1	AG-2	Country	R-20, R-10	R-7.5, R-5, R-3.5	A-1	A-2	A-3	AMX-1	AMX-2	AMX-3	Resort	B-1	B-2	BMX-3	BMX-4	I-1	I-2	I-3	IMX-1
Off-site joint development																C	C				
Personal services										P[1]	P[1]	P[1]	P	P	P	P	P				P[2]
Photographic processing														P	P	P	P	P	P		P
Photography studios													P	P	P	P	P				P[2]
Plant nurseries		P/c	P/c															P/c	P/c		P/c
Real estate offices													P/c	P	P	P	P				P[2]
Retail, accessory																		Ac	Ac	Ac	
Retail establishments													P	P	P	P	P				P[2]
Self-storage facilities															P/c	P/c	P/c	P	P		P
Trade or convention center	PRU	PRU	PRU	PRU			PRU	PRU	PRU	PRU	PRU	PRU	PRU	PRU	PRU	PRU	PRU	PRU	PRU	PRU	PRU
Travel agencies													P	P	P	P	P				P[2]
Veterinary establishments														P/c	P/c	P/c	P/c	P	P		P/c
DWELLINGS AND LODGINGS																					
Boarding facilities							P	P	P	P	P	P				P	P				
Consulates					P/c	P/c	P	P	P	P	P	P	P	P	P	P	P				
Duplex units						P	P	P	P	P	P	P	P			P					
Dwellings, owner's or caretaker's, accessory														Ac	Ac		Ac	Ac	Ac	Ac	Ac

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USES (Note: Certain uses are defined in Article 10.1)	ZONING DISTRICTS																				
	P-2	AG-1	AG-2	Country	R-20, R-10	R-7.5, R-5, R-3.5	A-1	A-2	A-3	AMX-1	AMX-2	AMX-3	Resort	B-1	B-2	BMX-3	BMX-4	I-1	I-2	I-3	IMX-1
Dwellings for cemetery caretakers	Ac		Ac																		
Dwellings, detached, one-family				P	P	P	P	P	P	P	P	P	P			P					
Dwellings, detached, two-family						P	P	P	P	P	P	P	P			P					
Dwellings, multifamily							P	P	P	P	P	P	P			P/c	P				
Farm dwellings		P/c	P/c																		
Group living facilities		C	C	C	C	C	C	C	C	C	C	C				C	Cm				
Guest houses (R-20 only)					Ac																
Hotels													P				P		Cm		Cm
Roomers/Rooming				Ac	Ac	Ac															
Special needs housing for the elderly							C	C	C	C	C	C				C	C				
Time sharing								P/c					P								
Transient vacation units								P/c					P								
Vacation cabins	C																				
INDUSTRIAL																					
Base yards																		P/c	P/c	P/c	P/c
Biofuel processing facilities	C	C	C																Cm	Cm	
Building or similar contracting and																		P	P		P

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USES (Note: Certain uses are defined in Article 10.1)	ZONING DISTRICTS																				
	P-2	AG-1	AG-2	Country	R-20, R-10	R-7.5, R-5, R-3.5	A-1	A-2	A-3	AMX-1	AMX-2	AMX-3	Resort	B-1	B-2	BMX-3	BMX-4	I-1	I-2	I-3	IMX-1
Home improvement and furnishing services, and materials and equipment sales or distribution; provided incidental storage of materials or equipment is within fully enclosed buildings																					
Centralized mail and package handling facilities																		P/c	P	P	P/c
Explosive and toxic chemical manufacturing, storage and distribution																			C		
Food manufacturing and processing															P/c	P/c	P/c	P	P	P	P
Freight movers																		P/c	P		
Heavy equipment sales and rentals																		P/c	P		
Linen suppliers																		P	P		
Manufacturing, processing and packaging, light																		P	P	P	P
Manufacturing, processing and packaging, general																		P/c	P	P	
Maritime-related vocational training, sales, construction,																			P	P	

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USES (Note: Certain uses are defined in Article 10.1)	ZONING DISTRICTS																				
	P-2	AG-1	AG-2	Country	R-20, R-10	R-7.5, R-5, R-3.5	A-1	A-2	A-3	AMX-1	AMX-2	AMX-3	Resort	B-1	B-2	BMX-3	BMX-4	I-1	I-2	I-3	IMX-1
maintenance and repairing																					
Motion picture and television production studios															P/c	P/c		P	P		P
Petroleum processing																			C	Cm	
Port facilities																				P	
Publishing plants for newspapers, books and magazines															P		P	P	P		P
Repair establishments, major																		P/c	P	P	
Repair establishments, minor														P	P	P	P	P	P	P	P
Resource extraction	C	C	C																P		
Salvage, scrap and junk storage and processing																			Cm	Cm	
Storage yards																		P/c	P/c	P/c	
Warehousing																		P	P	P	P
Waste disposal and processing	C		C																Cm	Cm	
Wholesale and retail establishments dealing primarily in bulk materials delivered by or to ship, or by ship and truck in combination																				P	
Wholesaling and distribution															P/c	P/c	P	P	P		P

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USES (Note: Certain uses are defined in Article 10.1)	ZONING DISTRICTS																				
	P-2	AG-1	AG-2	Country	R-20, R-10	R-7.5, R-5, R-3.5	A-1	A-2	A-3	AMX-1	AMX-2	AMX-3	Resort	B-1	B-2	BMX-3	BMX-4	I-1	I-2	I-3	IMX-1
OUTDOOR RECREATION																					
Amusement facilities, outdoor, not motorized													C	C	C		C	C	C		Cm
Amusement facilities, outdoor, motorized													C	C	C		C	C	C		Cm
Golf courses	PRU P/c												P								
Marina accessories	Cm												Cm		Cm	Cm	Cm		P	P	P/c
Recreation facilities, outdoor	Cm		Cm	Cm									P	Cm	Cm	Cm	Cm				
SOCIAL AND CIVIC SERVICE																					
Art galleries and museums													P	P	P	P	P				P[2]
Cemeteries and columbaria	P		Cm																		
Colleges, business													P		P	P	P				
Day-care facilities			C	Cm	Cm	Cm	Cm	Cm	Cm	Cm	Cm	Cm	P	P	P	P	P	P	P		P
Hospitals	PRU	PRU	PRU	PRU	PRU	PRU	PRU	PRU	PRU	PRU	PRU	PRU	PRU	PRU	PRU	PRU	PRU	PRU	PRU	PRU	PRU
Meeting facilities			Cm	Cm	Cm	Cm	Cm	Cm	Cm	Cm	Cm	Cm	P	P	P	P	P	P/c	P/c		P
Prisons	PRU	PRU	PRU	PRU	PRU	PRU	PRU	PRU	PRU	PRU	PRU	PRU	PRU	PRU	PRU	PRU	PRU	PRU	PRU	PRU	PRU
Public uses and structures	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P

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Uses (Note: Certain uses are defined in Article 10.1)	ZONING DISTRICTS																				
	P-2	AG-1	AG-2	Country	R-20, R-10	R-7.5, R-5, R-3.5	A-1	A-2	A-3	AMX-1	AMX-2	AMX-3	Resort	B-1	B-2	BMX-3	BMX-4	I-1	I-2	I-3	IMX-1
Schools, business												P	P	P	P	P	P				
Schools: Elementary, intermediate and high			Cm	Cm	Cm	Cm	Cm	Cm	Cm	Cm	Cm	Cm		P	P	P	P				
Schools, language				P/c	P/c	P/c	P/c	P/c	P/c	P/c	P/c	P/c	P/c	P	P	P	P				
Schools, vocational, technical, industrial, trade																		P	P		P
Schools, vocational, which do not involve the operation of woodwork shops, machine shops or other similar features													P	P	P	P	P				P
Theaters													P	P	P	P	P				P[4]
Universities, colleges	PRU	PRU	PRU	PRU	PRU	PRU	PRU	PRU	PRU	PRU	PRU	PRU	PRU	PRU	PRU	PRU	PRU	PRU	PRU	PRU	PRU
TRANSPORTATION AND PARKING																					
Airports	PRU	PRU	PRU	PRU	PRU	PRU	PRU	PRU	PRU	PRU	PRU	PRU	PRU	PRU	PRU	PRU	PRU	PRU	PRU	PRU	PRU
Automobile service stations														Cm P	P	P	P	P	P		P
Car washing, mechanized														P/c	P/c	P/c	P/c	P/c	P/c		P/c
Commercial parking lots and garages										P/c[1]	P/c[1]	P/c[1]	P	P	P	P	P	P	P		P
Heliports																			P		
Helistops		C	C										C		C	C	C	C	P	P	C
Joint use of parking facilities				Cm	Cm	Cm	Cm	Cm	Cm	Cm	Cm	Cm	Cm	Cm	Cm	Cm	Cm	Cm	Cm	Cm	Cm
Off-site parking facilities				Cm	Cm	Cm	Cm	Cm	Cm	Cm	Cm	Cm	Cm	Cm	Cm	Cm	Cm	Cm	Cm	Cm	Cm
Truck terminals																			P	P	
UTILITIES AND COMMUNICATIONS																					
Antennas, broadcasting	Cm	Cm	Cm															C	C	C	C
Antennas, receive-only	Ac	Ac	Ac	Ac	Ac	Ac	Ac	Ac	Ac	Ac	Ac	Ac	Ac	Ac	Ac	Ac	Ac	Ac	Ac	Ac	Ac
Broadcasting stations													P		P	P	P	P	P	P	P
Utility installations, Type A	P/c	P/c	P/c	P	P	P	P	P/c	P/c	P	P/c	P/c	P/c	P/c	P/c	P/c	P/c	P/c	P/c	P/c	P/c
Utility installations, Type B	Cm	Cm	Cm	Cm	Cm	Cm	Cm	Cm	Cm	Cm	Cm	Cm	Cm	Cm	Cm	Cm	Cm	Cm	Cm	Cm	Cm
Wind machines		Cm Ac	Cm Ac	Cm Ac	Cm	Cm								Cm	Cm			Cm	Cm		Cm
MISCELLANEOUS																					
Historic structures, use of	Cm	Cm	Cm	C	C	C	C	C	C	Cm	Cm	Cm	Cm	Cm	Cm	Cm	Cm	Cm	Cm	Cm	Cm
Joint development	Cm	Cm	Cm	Cm	Cm	Cm	Cm	Cm	Cm	Cm	Cm	Cm	Cm	Cm	Cm	Cm	Cm	Cm	Cm	Cm	Cm

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(c) Additional Development Standards.

(1) Except for necessary access drives and walkways, all yards shall be landscaped.

(2) B-1 District Transitional Height Setback. Where a zoning lot adjoins a zoning lot in a residential district, the residential district height setbacks shall be applicable at the buildable area boundary line of the adjoining side of the B-1 zoning lot (see Figure 21-3.5).

(3) B-2 District Transitional Height Setback.

(A) Where a zoning lot adjoins a zoning lot in a residential, A-1 or AMX-1 district, the residential district height setback shall be applicable at the buildable area boundary line of the adjoining side of the B-2 zoning lot (see Figure 21-3.5).

(B) Where a zoning lot adjoins a zoning lot in an A-2, A-3, AMX-2, AMX-3 or resort district, no portion of a structure shall exceed 40 feet in height along the buildable area boundary line on the adjoining side of the B-2 zoning lot, provided that additional height shall be permitted if the additional height is set back one foot from the buildable area boundary line for each 10 feet in height or fraction thereof. This setback shall be a continuous plane from the top of the structure to the beginning of the additional height (see Figure 21-3.5).

(4) Street Setbacks. Within the B-2 district, no portion of a structure shall exceed a height equal to twice the distance from the structure to the vertical projection of the center line of any street (see Figure 21-3.7).

(5) Open Space Bonus. Within the B-2 district:

(A) For each square foot of public open space provided, five square feet of floor area may be added, exclusive of required yards;

(B) For each square foot of arcade area provided, three square feet of floor area may be added, exclusive of required yards; and

(C) Maximum density with open space bonuses shall not exceed an FAR as provided under Table 21-3.4.

(Added by Ord. 99-12)

Sec. 21-3.120 Business mixed use districts--Purpose and intent.

(a) The purpose of the business mixed use districts is to recognize that certain areas of the city have historically been mixtures of commercial and residential uses, occurring vertically and horizontally and to encourage the continuance and strengthening of this pattern. It is the intent to provide residences in very close proximity to employment and retail opportunities, provide innovative and stimulating living environments and reduce overall neighborhood energy consumption.

(b) The intent of the BMX-3 community business mixed use districts is to provide areas for both commercial and residential uses outside of the central business mixed use district and at a lower intensity than the central business mixed use district. Typically, this district would be applied to areas along major thoroughfares adjacent to B-2, BMX-4, A-3, AMX-2 and AMX-3 zoning districts. It is also intended that it be applied to areas where the existing land use pattern is already a mixture of commercial and residential uses, occurring horizontally, vertically or both.

(c) The intent of the BMX-4 central business mixed use district is to set apart that portion of Honolulu which forms the city's center for financial, office and governmental activities and housing. It is intended for the downtown area and not intended for general application. It provides the highest land use intensity for commerce, business and housing.

(Added by Ord. 99-12)

Sec. 21-3.120-1 BMX-4 business mixed use special height controls.

(a) Any development which is proposed to exceed a height limit of 350 feet shall comply with the following:

(1) Minimum Project Size. The minimum project size shall be 35,000 square feet.

(2) Site Plan. The request for additional height shall include a proposed site plan, which shall include the location and height of building towers, and shall take into consideration adjacent uses and structures. Specifically, the following principles shall be reflected in the site plan, and

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- P = Permitted use
- Pr = Permitted use subject to standards in Article 5
- PRU = Plan Review Use

Uses Note: Conditions are listed in Article 10.1	ZONING DISTRICTS																			
	P-2	AG-1	AG-2	Country	R-20, R-10	R-7.5, R-5, R-3.5	A-1	A-2	A-3	AMX-1	AMX-2	AMX-3	Resort	B-1	B-2	BMX-3	BMX-4	I-1	I-2	I-3	IMX-1
Where a proposed use is not specifically listed above, the director shall review the proposed use and, based on its characteristics and its similarity to the uses listed above, shall determine the regulatory requirements for that use.																				
[1] Commercial use subject to special density controls (see Table 21-3.3 and Section 21-3.90-1(c)(4)).																				
[2] Commercial use subject to special density controls (see Table 21-3.5 and Section 21-3.140-1(c)).																				

(Added by Ord. 99-12; Am. Ord. 00-09, 01-12, 02-63, 03-37, 07-14, 07-15, 09-26, 10-19)

the applicant shall demonstrate how these principles are being met:

(A) Building towers shall not significantly obstruct or intrude on adopted public views.

(B) Proposed open spaces shall complement and relate to adjacent open spaces.

(C) Ground level parking lots and structures should not front streets. Where this is not possible, canopy and vertical form trees, hedges and other landscaping elements shall be provided to visually screen them.

(D) The additional tower height shall not unreasonably block the provision of light and air to other buildings and public open spaces, nor obliterate direct exposure to the sun in any given 24-hour period.

(3) Public Open Space. A minimum of 35 percent of the lot area shall be devoted to public open space in accordance with Table 21-3.4.

(4) Public Views. The additional tower height shall not significantly intrude on any adopted public views, including the view of the central business district from the Punchbowl lookouts.

(5) Pedestrian Orientation. Project design at the ground level shall reflect a strong pedestrian orientation, especially fronting streets. Contributing elements include, but are not limited to:

(A) Arcades, with at least one-half of the arcade perimeter open or devoted to entrances and show windows.

(B) Public open spaces, with provisions for shade, seating areas, landscaping, water features and outdoor sculptures.

(C) Outdoor dining areas.

(D) Interesting paving design and finishes.

(E) Building materials, finishes and details which are human-scaled, nonglaring and not harsh.

(6) Wind Analysis. The request for additional height shall include a wind study of the effects of towers over 350 feet, particularly anticipated impacts at the ground level. Where adverse impacts are anticipated, mitigative measures shall be included in the proposal.

(7) Historic Resources. Any development which includes sites and/or structures on or eligible for inclusion on the national or state register of historic places or on the Oahu register of historic places shall be evaluated as to the feasibility and appropriateness of retaining the site and/or structure. For every square foot of building area of a site and/or structure on or eligible for inclusion on the national or state register of historic places or on the Oahu register of historic places, 10 square feet of additional floor area may be permitted above 350 feet of building height. This bonus shall be available even if the minimum open space requirements for subdivision (3) are not met.

(8) FAA Clearance. The request for additional height shall include a statement from the Federal Aviation Administration that the proposed building heights will not interfere with the operation of the Honolulu International Airport.

(9) Maximum Density. The maximum density as set forth in Table 21-3.4 shall not be exceeded.

(10) For purposes of this section, an "adopted public view" is a view that has been recognized as significant or otherwise worthy of protection by an adopted ordinance, including Article 9.

(b) Applications to exceed a height limit of 350 feet shall be processed pursuant to the requirements for major permits (special district), as set forth in Section 21-2.40-2.

(Added by Ord. 99-12)

Sec. 21-3.120-2 Business mixed use district uses and development standards.

(a) Within the business mixed use districts, permitted uses and structures shall be as enumerated in Table 21-3.

(b) Within the business mixed use districts, development standards shall be as enumerated in Table 21-3.4.

(c) Additional Development Standards.

(1) Except for necessary access drives and walkways, all yards shall be landscaped.

(2) BMX-3 District Transitional Height Setbacks.

(A) Where a zoning lot adjoins a zoning lot in a residential, A-1 or AMX-1 district, the residential district height setback shall be applicable at the buildable area boundary

line of the adjoining side of the BMX-3 zoning lot (see Figure 21-3.5).

(B) Where a zoning lot adjoins a zoning lot in an A-2, A-3, AMX-2, AMX-3 or resort district, no portion of a structure shall exceed 40 feet in height along the buildable area boundary line on the adjoining side of the BMX-3 zoning lot, provided that additional height shall be permitted if the additional height is set back one foot from the buildable area boundary line for each 10 feet in height or fraction thereof. This setback shall be a continuous plane from the top of the structure to the beginning of the additional height (see Figure 21-3.5).

(3) BMX-4 District Transitional Height Setback. Where a zoning lot adjoins a zoning lot in a residential, apartment, apartment mixed use or resort district, the height setback of the adjoining district shall be applicable at the buildable area boundary line of the adjoining side of the BMX-4 lot (see Figure 21-3.5).

(4) BMX-4 District Height Setback. For a minimum of 50 percent of any contiguous street frontage, no portion of a structure located on a lot adjacent to a street shall exceed a height which is intersected by a plane over the buildable area which makes an angle of 65 degrees with the horizontal at ground elevation at the center line of the street (see Figure 21-3.9).

(5) Street Setbacks and Street Trees.

(A) Within the BMX-3 district, no portion of a structure shall exceed a height equal to twice the distance from the structure to the vertical projection of the center line of any street (see Figure 21-3.7).

(B) If a street tree plan exists for the street which fronts the project, the applicant shall install a street tree or trees, as required by the director.

(6) BMX-3 District Open Space Bonus.

(A) For each square foot of public open space provided, five square feet of floor area may be added, exclusive of required yards;

(B) For each square foot of arcade area provided, three square feet of floor area may be added, exclusive of required yards; and

(C) Maximum density with open space bonuses shall not exceed an FAR as provided under Table 21-3.4.

(7) BMX-4 District Open Space Bonus.

(A) For each square foot of public open space provided, 10 square feet of floor area may be added. If provided, front yards may be included as public open space;

(B) For each square foot of arcade area provided, five square feet of floor area may be added;

(C) Maximum density with open space bonuses shall not exceed an FAR as provided under Table 21-3.4; and

(D) For developments which exceed a height of 350 feet, for each square foot of public open space provided, 10 square feet of floor area may be added below 350 feet of building height or seven square feet of floor area may be added above 350 feet of building height. If provided, front yards may be included as public open space.

(8) BMX-4 District Heights Above 350 Feet. For developments which exceed a height of 350 feet, but are permitted higher heights on the zoning maps, refer to Section 21-3.120-1.

(9) Historic Resources Bonus. For developments in the BMX-4 district which exceed a height of 350 feet, refer to Section 21-3.120-1 for provisions relating to additional floor area permitted for preservation of historic resources.

(Added by Ord. 99-12)

Table 21-3.4
Resort, Business and Business Mixed Use Districts
Development Standards

Development Standard		District				
		Resort	B-1	B-2	BMX-3	BMX-4
Minimum lot area (square feet)		15,000[1]	5,000	5,000	5,000	5,000
Minimum lot width and depth (feet)		70[1]	50	50	50	50
Yards (feet):	**Front**	25	10	5[4]	10 for dwellings, 5 for other uses[4]	5[4,5]
	Side and rear	20[2]	0[3]	0[3]	5[2] for detached dwellings, 10 for multifamily dwellings, 0[3] for other uses	0[3]
Maximum building area (percent of zoning lot)		50	not regulated			
Maximum density (FAR) resort district only		**Lot area (sq. ft.)** / **FAR calculation** Less than 10,000: FAR = (.00006 x lot area) + 0.4 10,000 - 30,000: FAR = (.00002 x lot area) + 0.8 Over 30,000: FAR = 1.4				
Maximum density (FAR) for other districts		see above	1.0	2.5	2.5	4.0
Open space bonus	**Available**	No		Yes see Sec. 21-3.110-1(c)	Yes see Sec. 21-3.120-2(c)	
	Max FAR	n/a	n/a	3.5	3.5	7.5
Maximum height (feet)		per zoning map	40	per zoning map	per zoning map	per zoning map, see Sec. 21-3.120-1 for additional height
Height setbacks		per Sec. 21-3.100-1(c)	per Sec. 21-3.110-1(c)		per Sec. 21-3.120-2(c)	

[1]There shall be no minimum lot area, width or depth for off-site parking facilities.
[2]For duplex lots, 5 feet for any portion of any structure not located on the common property line; the required side yard is zero feet for that portion of the lot containing the common wall.
[3]Where the side or rear property line of a zoning lot adjoins the side or rear yard of a zoning lot in a residential, apartment or apartment mixed use district, there shall be a side or rear yard which conforms to the yard requirements for dwelling use of the adjoining district. In addition, see Section 21-4.70-1 for landscaping and buffering

requirements.
[4]Where a zoning lot adjoins a residential, apartment or apartment mixed use district and forms a continuous front yard, the lot or the first 100 feet of the lot (whichever is less) shall conform to the front yard requirements for the dwelling use of the adjoining district (see Figure 21-3.6).
[5]Five feet for structures up to 12 feet in height, provided that where the adjacent street is greater than 50 feet in width, an area of open space or an arcade, equivalent to the required yard area may be provided elsewhere on the zoning lot (see Figure 21-3.8).

n/a = Not applicable
(Added by Ord. 99-12; Am. Ord. 03-37)

Sec. 21-3.130 Industrial districts--Purpose and intent.

(a) The purpose of the industrial districts is to recognize the importance of industrial uses to the welfare of city residents by providing areas for industrial uses without undue competition from other uses and ensuring compatibility with nonindustrial areas. Typical uses include manufacturing, refining, sorting, processing and storage of materials and products. Limited business activities that directly support the industrial uses or those employed by industries therein are permitted in these districts.

(b) Heavy industrial uses such as refining of petroleum and manufacturing of explosives will only be allowed under certain conditions and in areas well away from other districts.

(c) To minimize potential adverse impacts on property and persons in the same or neighboring districts, standards are established for the more noxious uses permitted in these districts.

(d) The intent of the I-1 limited industrial district is to provide areas for some of the industrial employment and service needs of rural and suburban communities. It is intended to accommodate light manufacturing, including handcrafted goods as well as "high technology industries" such as telecommunications, computer parts manufacturing, and research and development. Uses in this district are limited to those which have few environmental impacts and those which complement the development scale of communities they would serve.

(e) The intent of the I-2 intensive industrial district is to set aside areas for the full range of industrial uses necessary to support the city. It is intended for areas with necessary supporting public infrastructure, near major transportation systems and with other locational characteristics necessary to support industrial centers. It shall be located in areas away from residential communities where certain heavy industrial uses would be allowed.

(f) The intent of the I-3 waterfront industrial district is to set apart and protect areas considered vital to the performance of port functions and to their efficient operation. It is the intent to permit a full range of facilities necessary for successful and efficient performance of port functions. It is intended to exclude uses which are not only inappropriate but which could locate elsewhere.

(Added by Ord. 99-12)

Sec. 21-3.130-1 Industrial uses and development standards.

(a) Within the industrial districts, permitted uses and structures shall be as enumerated in Table 21-3.

(b) Within the industrial districts, development standards shall be as enumerated in Table 21-3.5.

(c) Additional Development Standards.

(1) Transitional Height Setbacks. Where a zoning lot adjoins a zoning lot in a residential, apartment, apartment mixed use or resort district, the residential, apartment, apartment mixed use or resort district height setbacks shall be applicable at the buildable area boundary line on the side of the industrial zoning lot (see Figure 21-3.5).

(2) Street Setbacks. In the I-2 and I-3 districts, on zoning lots adjacent to a street, no portion of a structure shall exceed a height equal to twice the distance from the structure to the vertical projection of the center line of the street (see Figure 21-3.7).

(Added by Ord. 99-12)

Sec. 21-3.140 Industrial-commercial mixed use district--Purpose and intent.

Appendix D

Botanical Inventory Survey

Botanical Resurvey

of the

Debartolo Property

Ewa, Oʻahu

by

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Isle Botanica
Honolulu, Hawaiʻi

Report prepared for

Hawaiʻi Debartolo LLC

June 2011

INTRODUCTION

The study site (Fig. 1) is located in western Oʻahu on the Ewa Plain. The main portion ("Debartolo property," TMK 91016108) comprises a 67-acre parcel east of Kapolei and west of Varona Village. Its southern boundary is marked by Roosevelt Road and its northern boundary by the Kapolei Parkway. In addition to this parcel, a 200-ft wide strip of land on State property, contiguous with the eastern boundary of the Debartolo property, was also studied. The area was used for decades for growing sugar cane, but cultivation ceased long ago and the land abandoned. The southern part of the study area is an abandoned quarry, with large hills of excavated material in the center of the property lying north of a large barrow pit. Most of the rest of the site, including the State land to the east, is covered with non-native grasslands with or without shrubs and scattered trees.

METHODOLOGY

Before the fieldwork was carried out, a review of the literature was undertaken by the principal investigator. The current status of the endangered species previously reported from the surrounding area was checked using the official database of threatened and endangered plant species (USFWS 2005). This list is identical to the State of Hawaiʻi list of threatened and endangered species. In addition, information about threatened and endangered plant species found in the area was extracted from the Hawaiʻi Natural Heritage Program database (Anon. 2005) of Federally Listed Plant Species (see Fig. 2). Several botanical surveys have been carried out in the area, the most relevant of which were by Nagata (1996), Char and Associates (1997a, 2003, and 2004), and Whistler (2007). An endangered plant species, koʻoloaʻula (*Abutilon menziesii*), was found in the area by Nagata in 1996, and a mitigation plan for the species was prepared and carried out by the State (DLNR 2003).

After the literature review, a botanical field survey was conducted on the study area and the adjacent State property by the principal investigator on 25 June 2011. A "walk-through survey" was employed, and all plant species encountered were recorded, along with an indication of their frequency. Particular care was taken in looking for the federally listed endangered plant species koʻoloaʻula (*Abutilon menziesii*). The species encountered were incorporated into a checklist of all plants found at the study site (see Appendix I). Notes were also taken on vegetation types present, indicating the dominance and frequency of the plant species found there. These notes were written up into the vegetation description below. All the species encountered during the fieldwork were familiar to the principal investigator and were identified in the field.

The objectives of the current field study were to provide a general description of the vegetation types present at the site (particularly any sensitive types of vegetation that may harbor rare plant species), to make a checklist of all native and naturalized vascular plants encountered, to search for threatened and endangered species; and to determine whether any threatened or endangered plant species or sensitive types of vegetation (plant communities) present would be adversely affected by the proposed action.

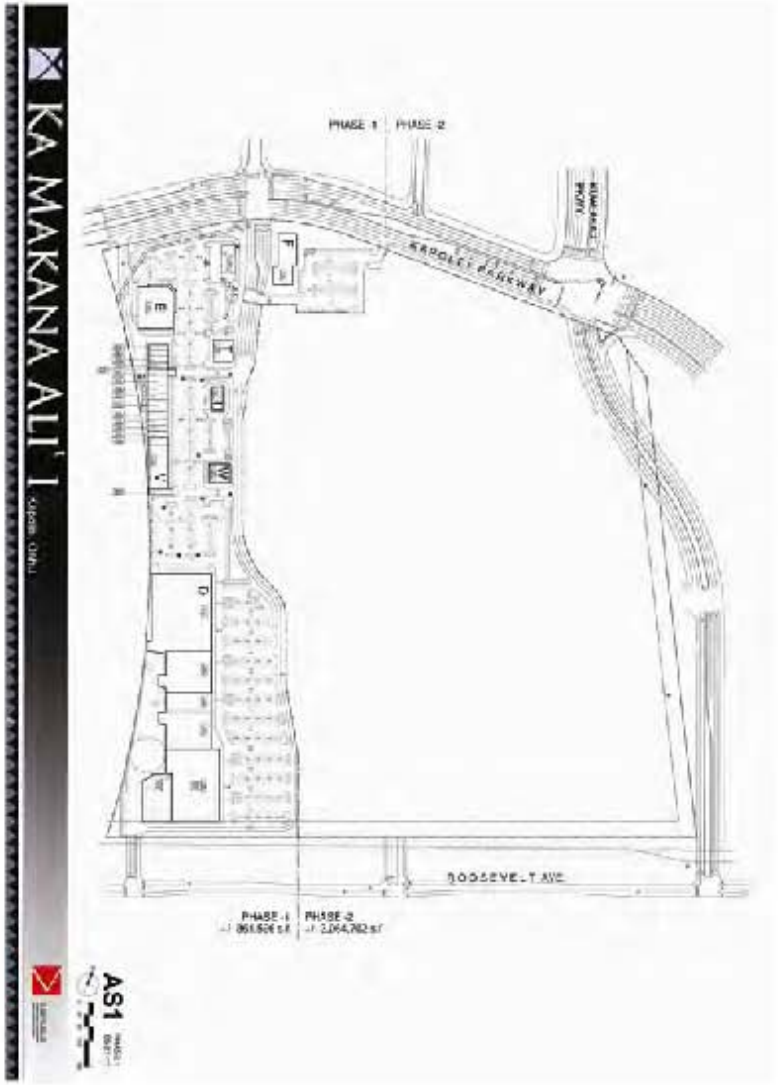

Fig. 1. The Debartolo study site.

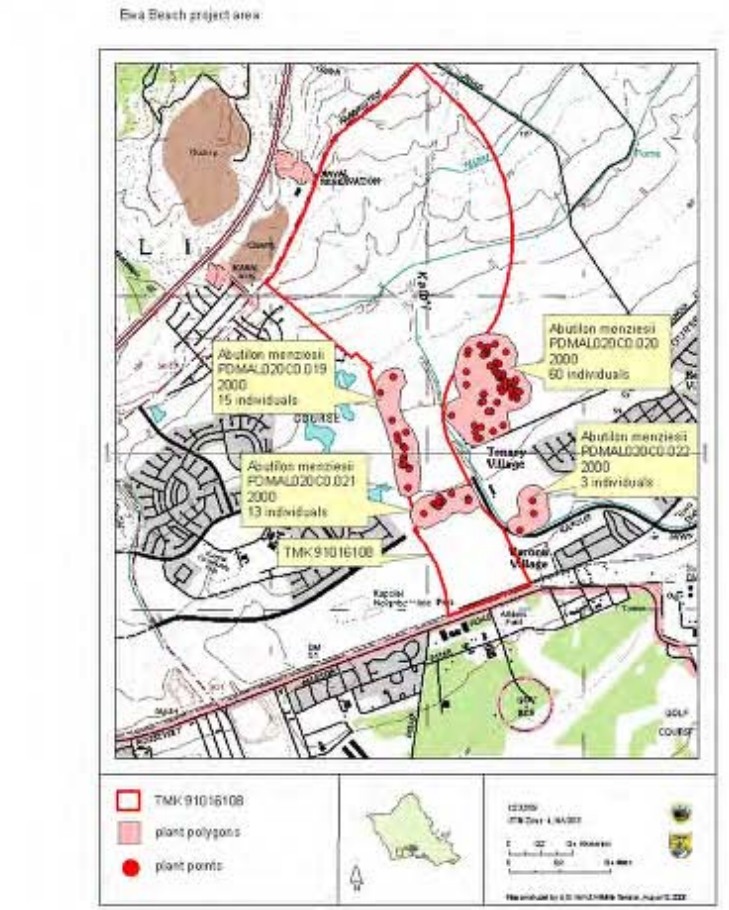

Fig. 2. Hawai‘i Natural Heritage Program database map of Federally Listed Plant Species in the vicinity of the Debartolo property study site (marked as TMK 91016018).

PREVIOUS LITERATURE

The study site is located in an area used for decades for cultivating sugar cane, but when this industry ceased operations in the area, the land was earmarked for development. A botanical survey was carried in 1996 on an area of approximately 1300 acres for the East Kapolei Master Plan, which includes the present study site (Nagata 1996). No native plant communities were found in the area, and 99 plant species were recorded. Among the 99 were five native species. Four of these are common and widespread, but a population of 38 individuals of the federally listed endangered plant koʻoloaʻula (*Abutilon menziesii*), clustered in four groups, was found and mapped. None of these individuals were recorded on the present study site, but some were very close to it. Since the land had been so heavily disturbed for so long, the USFWS determined that the populations were "secondary in origin."

Char and Associates (1997a) did a follow-up survey on the koʻoloaʻula populations in late 1996 after a heavy rainy period and recorded 88 individuals that they grouped into three colonies (lumping two of Nagata's groups into one, but not finding his northern-most population). They recommended a mitigation plan be initiated. This plan was eventually carried out (DLNR 2003). Seedlings and cuttings were propagated and some were outplanted to establish new wild populations in appropriate habitat near Kaʻena Point and in the Koko Crater botanical garden.

Char and Associates (1997b) did another botanical survey in 1996 the area for the proposed North-South Road Corridor. This area is north of and nearly contiguous with the present study site. They recorded 80 plant species present in this proposed corridor, five of them native or possibly native: ʻuhaloa (*Waltheria indica*), popolo (*Solanum americanum*), ʻilima (*Sida fallax*), maʻo (*Abutilon incanum*), and koʻoloaʻula (*Abutilon menziesii*). These are the same five native species recorded by Nagata (1996). The first four are common indigenous species, and the latter one a federally listed endangered plant species. Like Nagata, they found no native vegetation.

Another botanical survey was carried out in the area for the site of the proposed University of Hawaiʻi West Oʻahu campus north of the present study site (Char and Associates 2003). During that survey of the 500-acre parcel, 95 plant species were encountered. This included six native species: the same five listed above by both Char and Associates (1997b) and Nagata (1996), as well as the indigenous paʻu-o-Hiʻiaka (*Jacquemontia ovalifolia*), which is a common littoral plant in Hawaiʻi. No native vegetation was found, which was to be expected in this heavily disturbed area.

Char and Associates (2004) did another survey in the area for the "Kapolei Parkway Extension from North-South Road to OR&L Right of Way," which lies just east of the present study site. The western border of this site is contiguous with the eastern boundary of the Debartolo property, and hence its western-most 200 feet comprise the same area as the 200-ft wide corridor on State land that was studied during the present survey. The number of plant species found during this survey was not cited, but the same six native species encountered on the surveys listed above were recorded here. Char and Associates also found five new locations for koʻoloaʻula, but only one to a few individuals were found at each (Fig. 2 notes only 3 individuals total).

The most recent survey of the present study site was done several years ago by the present author (Whistler 2007). In that survey, which included a 500-ft wide State-owned corridor on the east side, 58 plant species were found, only four of them native. Three of the native species were common indigenous species, but a single individual of the endangered *Abutilon menziesii* (koʻoloaʻula) was also found in the adjacent 500 ft wide corridor.

THE VEGETATION

Two types of vegetation can be recognized at the study site: (1) Managed Land Vegetation; and (2) Buffel Grass Grassland. Both of these are classified as "disturbed vegetation," with only a few native species present. The latter type is not homogeneous, since it may be with or without kiawe trees or other species of shrubs, but the subtypes are united by the matrix of Buffel grass that they share. The vegetation types are described below. These are the same as those recognized in the previous botanical survey of the study site (Whistler 2007).

(1) Managed Land Vegetation

This comprises the vegetation on areas that are under periodic or frequent management, such as roadsides and unpaved roads (Fig. 3). The major portion of the Managed Land Vegetation at the site comprises the areas that have been used as a quarry on the southern half of the Debartolo property. This includes a large barrow pit and piles of excavated soil (Fig. 4) that cover most of the southern portion of the site. Much of the area, particularly the northern portion of the site and the adjacent State property, was probably once cultivated with sugar cane, but there is no sign of this cultivation or the sugar cane at the present time. The dominant plant species in this type of vegetation, especially along roadsides, include *Atriplex semibaccata* (Australian saltbush), swollen fingergrass (*Chloris barbata*), weedy heliotrope (*Heliotropium procumbens*), *Sida ciliaris* (no common name), and Dahlberg daisy (*Dyssodia tenuiloba*), and lesser amounts of other weedy species.

(2) Buffel Grass Grassland

This is a heterogeneous assemblage of subtypes united by the dominance of Buffel grass (*Cenchrus ciliaris*) as the ground cover. It was described as "Fallowed Fields Mixed Herb Associations" by Nagata (1996), and "mixed grass shrubland" by Char and Associates (1997b), and is the category recognized in the most recent botanical survey of the site (Whistler 2007). No other herbaceous species approaches the dominance of Buffel grass in this vegetation. In some places it is almost entirely this species, but in others it is mixed with lesser amounts of alien weedy species, particularly partridge pea (*Chamaecrista nictitans*), golden crown-beard (*Verbesina encelioides*), Guinea grass (*Panicum maximum*), fuzzy rattlepod (*Crotalaria incana*), and wild bushbean (*Macroptilium atropurpureum*), and the common native ʻuhaloa (*Waltheria indica*). In other places, scattered individuals of the trees koa haole (*Leucaena leucocephala*), kiawe (*Prosopis pallida*), and ʻopiuma (*Pithecellobium dulce*) are present (Fig. 5). The State property to the east of the Debartolo property is also covered with a dense matrix of Buffel grass, mixed with lesser amounts of other herbaceous species. A single shrub of the endangered koʻoloaʻula was found here during the 2007 survey, but it was not seen during the present survey and in any case was not within the 200 ft wide zone studied this time.

THE FLORA

Sixty-seven plant species were recorded at the study site (see Appendix 1) during the present survey. This included 19 species not found during the previous survey (Whistler 2007), but ten species found during that earlier survey were not found this time. Only six of the 77 species found during the two surveys are native, five of them indigenous, one endemic. Indigenous plants are species native to a region or place, but are also found elsewhere. Endemic plants are species restricted to a single region or area, i.e., in the case of Hawai‘i, they are found only in Hawai‘i. In biodiversity terms, the endemic status is the more important of the two categories, since if a species belonging to it is endangered or threatened in Hawai‘i, it would likewise be classified globally. Indigenous species, however, can be rare in Hawai‘i, but may be common elsewhere in the Pacific. Over 90% of the native plants in Hawai‘i are endemic, one of the highest rates in the world. The majority of the 67 species encountered during the survey are naturalized or weedy “alien” plants that were accidentally or intentionally introduced to Hawai‘i, but which have now become established in the islands and can spread on their own.

All five of the indigenous species found during the two surveys are common or occasional species. Two of them, ‘uhaloa (*Waltheria indica*) and ‘ilima (*Sida fallax*), are widespread species common in disturbed habitats in Hawai‘i. The third, *Jacquemontia ovalifolia* (pa‘u-o-Hi‘i‘aka), is found in the Caribbean in addition to Hawai‘i. The fourth, hoary abutilon (*Abutilon incanum*), is occasional, but is only questionably native in Hawai‘i. The fifth, alena (*Boerhavia repens*), was not found during the present survey, but is common in Hawai‘i. The endemic species, ko‘oloa‘ula (*Abutilon menziesii*), is a federally listed endangered species, but it was not found on the site during the present survey.

The previous survey was conducted during a dry summer (August 2007) in an exceptional drought year. Although the present survey was also conducted during the dry season, this year so far has 50% above the average rainfall, and the last two months (May and June) have had four times the normal rainfall for this period. This has resulted in an unusually verdant lowland condition for this time of year. This probably accounts for the number of new species recorded for the site (19).

DISCUSSION

The study was conducted in June 2011. Two types of vegetation can be recognized at the site: Managed Land Vegetation and Buffel Grass Grassland. Both of these are heavily disturbed. The latter is heterogeneous, with subtypes most notably recognized by the presence or absence of trees or shrubs in the matrix of Buffel grass. No native vegetation is present due to the decades of sugar cane cultivation. Likewise, no wetlands were found, since the area is so dry and the soil unsuitable for this kind of vegetation.

Sixty-seven plant species were found during the survey, four of them indigenous: ‘ilima (*Sida fallax*), ‘uhaloa (*Waltheria indica*), pa‘u-o-Hi‘i‘aka (*Jacquemontia ovalifolia*), and ma‘o (*Abutilon incanum*). The first three are common in Hawai‘i, often in disturbed places, the latter is occasional (and is questionably native). Only two other indigenous species have been reported from the area during previous surveys, popolo (*Solanum americanum*) and alena (*Boerhavia repens*). Both are widespread and common indigenous plants in Hawai‘i. Ten other species found during the previous survey (Whistler 2007) were not found during the present one, but all except one of these are weedy alien species that were listed as “uncommon” in the 2007 report.

One endangered species was found in the area during previous surveys, ko‘oloa‘ula (*Abutilon menziesii*). Ko‘oloa‘ula is a much-branched shrub belonging to the mallow family Malvaceae. It is now rare in the lowlands of Hawai‘i, and was listed as Endangered in 1986 (Federal Register 1986). Prior to 1996, only a few plants had been found on O‘ahu, but in that year a population of 38 individuals was discovered in abandoned sugar cane fields (Nagata 1996). A later survey after a period of heavy rain recorded 88 individuals (Char and Associates 1997a). A single individual was found during the 2007 survey about 270 feet east of the western boundary of the State property, and is apparently the same individual recorded by Char and Associates (2003) at “location no. 5.” If it still exists, it was not seen during the present survey, and in any case, it was east of the present study area.

The present survey was carried out in the dry season, but this has been a very wet year and it is unlikely that more species would be found during a wet season survey. Any additional species would most likely be alien weeds in any case.

CONCLUSIONS

Two botanical factors can complicate proposed construction in Hawai‘i. One is the presence of sensitive types of vegetation, the other is the presence of endangered plant species. Sensitive vegetation includes wetlands and native forest. No wetlands or native forests are found in the area, since the topography is not suitable (no basins) and the area is so highly disturbed. Only four native species turned up in the survey, all of them indigenous and none are rare in Hawai‘i. The only plant that could cause any problem is the federally listed ko‘oloa‘ula, but it was not found in the study area during the present survey, nor in any previous survey.

Consequently, there are no botanical reasons why development of the parcel cannot take place. This includes the main parcel and the 200 ft wide strip of State land. All of the proposed development is on very disturbed land.

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APPENDIX 1. PLANT SPECIES CHECKLIST

The following is a checklist of the vascular plants inventoried during the field study at the Debartolo and adjacent State properties during the 2011 survey. The plants are divided into two groups, Monocots, and Dicots. Within these groups, the species are presented taxonomically by family, with each family and each species in the family in alphabetical order. The taxonomy and nomenclature follow Wagner *et al*. (1999). In most cases, common English and/or Hawaiian names listed here have been taken from St. John (1973) or Porter (1972).

For each species, the following information is provided:

1. Scientific name with author citation.
2. Common English and/or Hawaiian name, when known.
3. Biogeographic status. The following symbols are used.
   - E = endemic (found only in Hawai‘i).
   - I = indigenous (native to Hawai‘i as well as other geographic areas).
   - P = Polynesian introduction (introduced to Hawai‘i by Polynesians before the advent of the Europeans).
   - X = Introduced or alien (not native, introduced to Hawai‘i, either accidentally or intentionally, after the advent of the Europeans).
4. Relative frequency (abundant, locally abundant, common, locally common, occasional, uncommon, rare).

* Indicates new species not recorded during the 2007 survey.

Species	Common Names	Status	Abundance
MONOCOTS			
POACEAE (Grass Family)			
Cenchrus ciliaris L.	Buffel grass	X	abundant
**Cenchrus echinatus* L.	sandbur	X	uncommon
Chloris barbata (L.) Sw.	swollen fingergrass	X	common
Cynodon dactylon (L.) Pers.	Bermuda grass	X	locally common
**Dactyloctenium aegyptium* (L.) Willd.	beach wiregrass	X	uncommon
**Digitaria* cf. *violascens* Link	violet crabgrass	X	rare
Eragrostis cf. *cilianensis* (All.) Link	stink grass	X	
Panicum maximum Jacq.	Guinea grass	X	occasional
Rhynchelytrum repens (Willd.) C.E. Hubb.	Natal redtop	X	uncommon
**Setaria verticillata* (L.) P. Beauv.	bristly foxtail	X	locally common
DICOTS			
AMARANTHACEAE (Amaranth Family)			
**Achyranthes aspera* L.	----------	X	uncommon
**Amaranthus pungens* Kunth	khaki weed	X	uncommon
Amaranthus spinosus L.	spiny amaranth	X	occasional
**Amaranthus viridis* L.	slender amaranth	X	rare
ANACARDIACEAE (Mango Family)			
Schinus terebinthifolius Raddi	Christmas berry	X	not found 2011
AIZOACEAE (Carpetweed Family)			
Tetragonia tetragonioides (Pall.) Kuntze	New Zealand spinach	X	uncommon
ASTERACEAE (Sunflower Family)			
**Bidens pilosa* L.	beggar’s-tick	X	uncommon
Conyza bonariensis (L.) Cronq.	hairy horseweed	X	occasional

Species	Common Names	Status	Abundance
ASTERACEAE (cont'd.)			
Dyssodia tenuiloba A.P. de Candolle	Dahlberg daisy	X	locally common
**Emilia fosbergii* Nicolson	red pualele, emilia	X	uncommon
**Lactuca serriola* L.	prickly lettuce	X	occasional
Pluchea carolinensis (Jacq.) G. Don	pluchea	X	common
Pluchea xfosbergii Cooperr. & Galang	hybrid pluchea	X	not found 2011
Pluchea indica (L.) Less.	Indian pluchea	X	not found 2011
Sonchus oleraceus L.	sow thistle	X	occasional
Tridax procumbens L.	coat buttons	X	occasional
Verbesina encelioides (Cav.) Benth. & Hook.	golden crownbeard	X	common
**Xanthium strumarium* L.	cocklebur	X	uncommon
BIGNONIACEAE (Bignonia Family)			
Spathodea campanulata P. Beauv.	African tulip tree	X	uncommon
BORAGINACEAE (Heliotrope Family)			
Cordia dichotoma Forst. f.	sebestan	X	occasional
Heliotropium procumbens Mill.	weedy heliotrope	X	locally common
BRASSICACEAE (Mustard Family)			
**Lepidium virginicum* L.	wild peppergrass	X	uncommon
CHENOPODIACEAE (Goosefoot Family)			
Atriplex semibaccata R. Br.	Australian saltbush	X	common
Atriplex subrecta Verd.	----------	X	not found 2011
Salsola kali L.	Russian thistle	X	not found 2011
CONVOLVULACEAE (Morning-Glory Family)			
Ipomoea obscura (L.) Ker-Gawl.	bindweed	X	occasional
**Ipomoea triloba* L.	pink bindweed	X	uncommon
**Jacquemontia ovalifolia* (Choisy) H. Hall.	pa'u-o-Hi'i'aka	I	rare
Merremia aegyptia (L.) Urb.	hairy merremia	X	occasional
CUCURBITACEAE (Gourd Family)			
Coccinea grandis (L.) Voigt	ivy gourd	X	rare
Cucumis dipsaceus Ehrenb. ex Spach	wild cucumber	X	occasional
Momordica charantia L.	wild bittermelon	X	uncommon
EUPHORBIACEAE (Spurge Family)			
Chamaesyce hirta (L.) Millsp.	garden spurge	X	common
Chamaesyce hypericifolia (L.) Millsp.	graceful spurge	X	common
**Chamaesyce prostrata* (Aiton) Small	prostrate spurge	X	occasional
Ricinus communis L.	castor bean	X	occasional
FABACEAE (Pea Family)			
Acacia confusa Merr.	Formosan koa	X	not found 2011
Acacia farnesiana (L.) Willd.	klu	X	rare
Chamaecrista nictitans (L.) Moench	partridge pea, lau-ki	X	locally common

Species	Common Names	Status	Abundance
FABACEAE (cont'd.)			
Crotalaria incana L.	fuzzy rattlepod	X	common
**Crotalaria pallida* Aiton	smooth rattlepod	X	uncommon
Desmanthus pernambucanus (L.) Thellung	virgate mimosa	X	common
Desmodium tortuosum (Sw.) DC.	Florida beggarweed	X	occasional
Indigofera spicata Forssk.	creeping indigo	X	locally common
Indigofera suffruticosa Mill.	indigo, 'iniko	X	occasional
Leucaena leucocephala (Lam.) de Wit	koa haole	X	common
Macroptilium atropurpureum (DC) Urb.	wild bushbean	X	locally common
Medicago polymorpha L.	bur clover	X	not found 2011
Pithecellobium dulce (Roxb.) Benth.	'opiuma, Manila tamarind	X	locally common
Prosopis pallida (Humb. & Bonpl. ex Willd.) Kunth	kiawe, mesquite	X	occasional
Samanea saman (Jacq.) Merr.	monkeypod	X	not found 2011
LAMIACEAE (Mint Family)			
Leonotis nepetifolia (L.) R. Br.	orange lion's-ear	X	occasional
MALVACEAE (Mallow Family)			
Abutilon grandifolium (Willd.) Sweet	hairy abutilon	X	uncommon
Abutilon incanum (Link) Sweet	ma'o, hoary abutilon	I?	uncommon
Abutilon menziesii Seem.	ko'oloa 'ula	E	not found 2011
**Malvastrum coromandelianum* (L.) Garcke	false mallow	X	occasional
Sida ciliaris L.	----------	X	locally common
Sida fallax Walp.	'ilima	I	occasional
Sida rhombifolia L.	Cuba jute	X	uncommon
Sida spinosa L.	prickly sida	X	locally common
NYCTAGINACEAE (Four-o'-Clock Family)			
Boerhavia repens R. Br.	alena, nena	I	not found 2011
PASSIFLORACEAE (Passionflower Family)			
Passiflora foetida L.	love-in-a-mist	X	uncommon
SOLANACEAE (Nightshade Family)			
Datura stramonium L.	Jimson weed	X	uncommon
**Lycopersicon pimpinellifolium* (Jusl.) Mill.	currant tomato	X	common
Nicotiana glauca R. C. Graham	tree tobacco	X	occasional
STERCULIACEAE (Cacao Family)			
Waltheria indica L.	'uhaloa	I	common
VERBENACEAE (Verbena Family)			
**Stachytarpheta jamaicensis* (L.) Vahl	Jamaica vervain, oi, owi	X	occasional

Fig. 3. Managed Land Vegetation at the study site.

Fig. 4. View from a hill showing quarrying deposits and Buffel Grass Grassland.

Fig. 5. Buffel Grass Grassland with scattered trees.

Appendix E

Fauna and Avifaunal Resource Inventory

Botanical Resurvey

of the

Debartolo Property

Ewa, Oʻahu

by

Art Whistler, Ph.D.
Isle Botanica
Honolulu, Hawaiʻi

Report prepared for

Hawaiʻi Debartolo LLC

June 2011

INTRODUCTION

The study site (Fig. 1) is located in western Oʻahu on the Ewa Plain. The main portion ("Debartolo property," TMK 91016108) comprises a 67-acre parcel east of Kapolei and west of Varona Village. Its southern boundary is marked by Roosevelt Road and its northern boundary by the Kapolei Parkway. In addition to this parcel, a 200-ft wide strip of land on State property, contiguous with the eastern boundary of the Debartolo property, was also studied. The area was used for decades for growing sugar cane, but cultivation ceased long ago and the land abandoned. The southern part of the study area is an abandoned quarry, with large hills of excavated material in the center of the property lying north of a large barrow pit. Most of the rest of the site, including the State land to the east, is covered with non-native grasslands with or without shrubs and scattered trees.

METHODOLOGY

Before the fieldwork was carried out, a review of the literature was undertaken by the principal investigator. The current status of the endangered species previously reported from the surrounding area was checked using the official database of threatened and endangered plant species (USFWS 2005). This list is identical to the State of Hawaiʻi list of threatened and endangered species. In addition, information about threatened and endangered plant species found in the area was extracted from the Hawaiʻi Natural Heritage Program database (Anon. 2005) of Federally Listed Plant Species (see Fig. 2). Several botanical surveys have been carried out in the area, the most relevant of which were by Nagata (1996), Char and Associates (1997a, 2003, and 2004), and Whistler (2007). An endangered plant species, koʻoloaʻula (*Abutilon menziesii*), was found in the area by Nagata in 1996, and a mitigation plan for the species was prepared and carried out by the State (DLNR 2003).

After the literature review, a botanical field survey was conducted on the study area and the adjacent State property by the principal investigator on 25 June 2011. A "walk-through survey" was employed, and all plant species encountered were recorded, along with an indication of their frequency. Particular care was taken in looking for the federally listed endangered plant species koʻoloaʻula (*Abutilon menziesii*). The species encountered were incorporated into a checklist of all plants found at the study site (see Appendix I). Notes were also taken on vegetation types present, indicating the dominance and frequency of the plant species found there. These notes were written up into the vegetation description below. All the species encountered during the fieldwork were familiar to the principal investigator and were identified in the field.

The objectives of the current field study were to provide a general description of the vegetation types present at the site (particularly any sensitive types of vegetation that may harbor rare plant species), to make a checklist of all native and naturalized vascular plants encountered, to search for threatened and endangered species; and to determine whether any threatened or endangered plant species or sensitive types of vegetation (plant communities) present would be adversely affected by the proposed action.

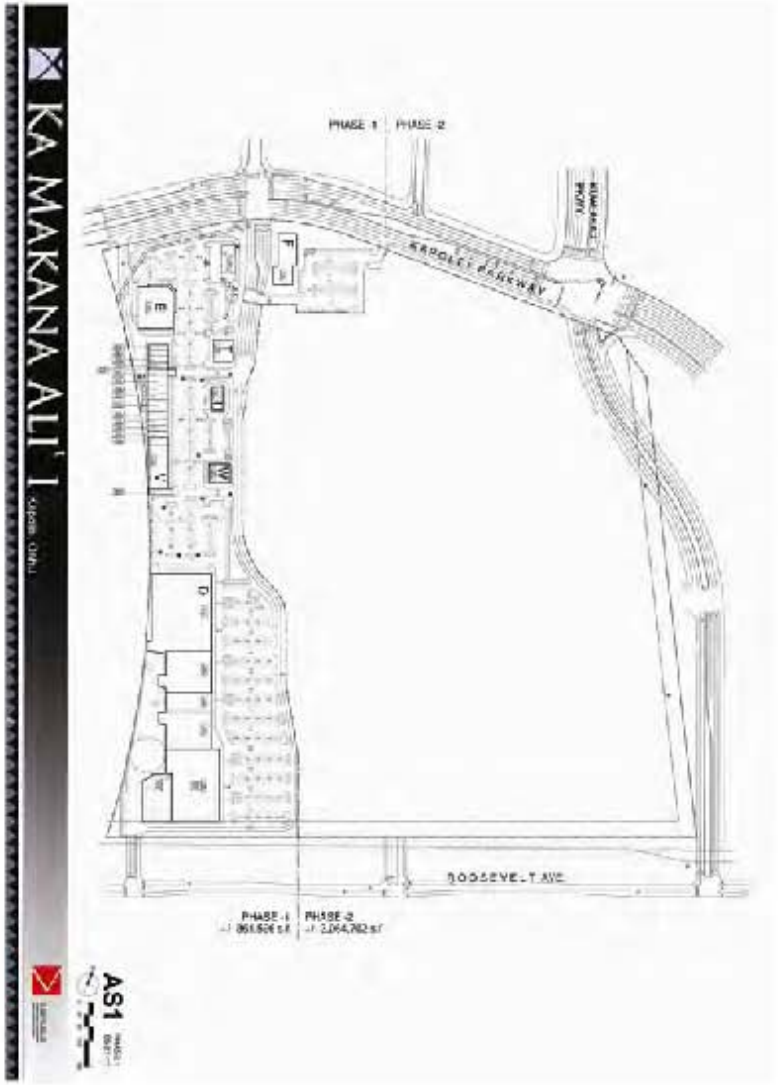

Fig. 1. The Debartolo study site.

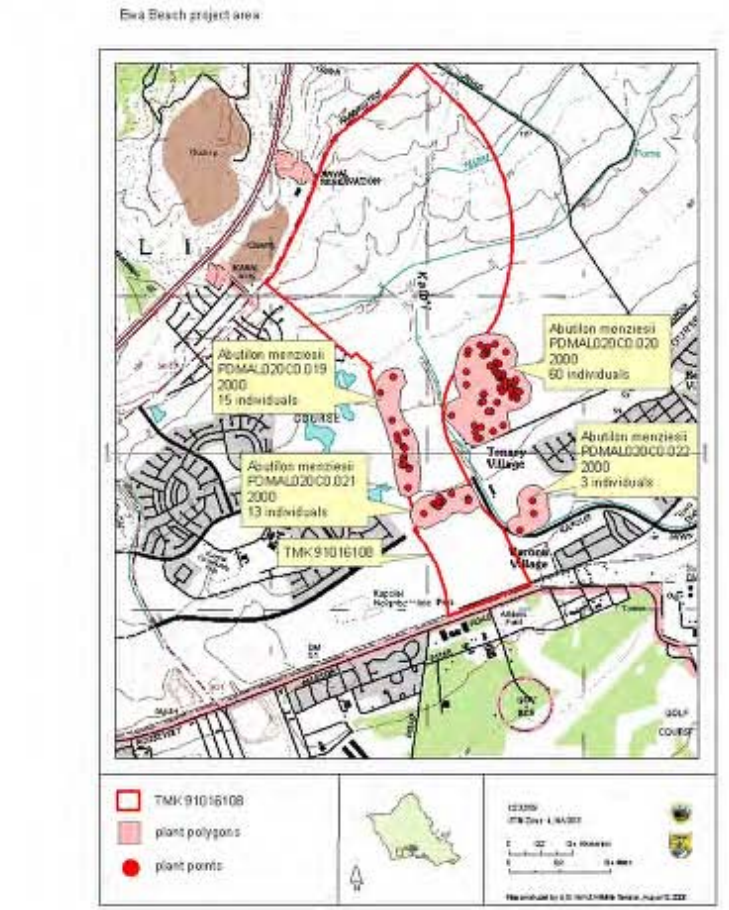

Fig. 2. Hawai‘i Natural Heritage Program database map of Federally Listed Plant Species in the vicinity of the Debartolo property study site (marked as TMK 91016018).

PREVIOUS LITERATURE

The study site is located in an area used for decades for cultivating sugar cane, but when this industry ceased operations in the area, the land was earmarked for development. A botanical survey was carried in 1996 on an area of approximately 1300 acres for the East Kapolei Master Plan, which includes the present study site (Nagata 1996). No native plant communities were found in the area, and 99 plant species were recorded. Among the 99 were five native species. Four of these are common and widespread, but a population of 38 individuals of the federally listed endangered plant koʻoloaʻula (*Abutilon menziesii*), clustered in four groups, was found and mapped. None of these individuals were recorded on the present study site, but some were very close to it. Since the land had been so heavily disturbed for so long, the USFWS determined that the populations were "secondary in origin."

Char and Associates (1997a) did a follow-up survey on the koʻoloaʻula populations in late 1996 after a heavy rainy period and recorded 88 individuals that they grouped into three colonies (lumping two of Nagata's groups into one, but not finding his northern-most population). They recommended a mitigation plan be initiated. This plan was eventually carried out (DLNR 2003). Seedlings and cuttings were propagated and some were outplanted to establish new wild populations in appropriate habitat near Kaʻena Point and in the Koko Crater botanical garden.

Char and Associates (1997b) did another botanical survey in 1996 the area for the proposed North-South Road Corridor. This area is north of and nearly contiguous with the present study site. They recorded 80 plant species present in this proposed corridor, five of them native or possibly native: ʻuhaloa (*Waltheria indica*), popolo (*Solanum americanum*), ʻilima (*Sida fallax*), maʻo (*Abutilon incanum*), and koʻoloaʻula (*Abutilon menziesii*). These are the same five native species recorded by Nagata (1996). The first four are common indigenous species, and the latter one a federally listed endangered plant species. Like Nagata, they found no native vegetation.

Another botanical survey was carried out in the area for the site of the proposed University of Hawaiʻi West Oʻahu campus north of the present study site (Char and Associates 2003). During that survey of the 500-acre parcel, 95 plant species were encountered. This included six native species: the same five listed above by both Char and Associates (1997b) and Nagata (1996), as well as the indigenous paʻu-o-Hiʻiaka (*Jacquemontia ovalifolia*), which is a common littoral plant in Hawaiʻi. No native vegetation was found, which was to be expected in this heavily disturbed area.

Char and Associates (2004) did another survey in the area for the "Kapolei Parkway Extension from North-South Road to OR&L Right of Way," which lies just east of the present study site. The western border of this site is contiguous with the eastern boundary of the Debartolo property, and hence its western-most 200 feet comprise the same area as the 200-ft wide corridor on State land that was studied during the present survey. The number of plant species found during this survey was not cited, but the same six native species encountered on the surveys listed above were recorded here. Char and Associates also found five new locations for koʻoloaʻula, but only one to a few individuals were found at each (Fig. 2 notes only 3 individuals total).

The most recent survey of the present study site was done several years ago by the present author (Whistler 2007). In that survey, which included a 500-ft wide State-owned corridor on the east side, 58 plant species were found, only four of them native. Three of the native species were common indigenous species, but a single individual of the endangered *Abutilon menziesii* (koʻoloaʻula) was also found in the adjacent 500 ft wide corridor.

THE VEGETATION

Two types of vegetation can be recognized at the study site: (1) Managed Land Vegetation; and (2) Buffel Grass Grassland. Both of these are classified as "disturbed vegetation," with only a few native species present. The latter type is not homogeneous, since it may be with or without kiawe trees or other species of shrubs, but the subtypes are united by the matrix of Buffel grass that they share. The vegetation types are described below. These are the same as those recognized in the previous botanical survey of the study site (Whistler 2007).

(1) Managed Land Vegetation

This comprises the vegetation on areas that are under periodic or frequent management, such as roadsides and unpaved roads (Fig. 3). The major portion of the Managed Land Vegetation at the site comprises the areas that have been used as a quarry on the southern half of the Debartolo property. This includes a large barrow pit and piles of excavated soil (Fig. 4) that cover most of the southern portion of the site. Much of the area, particularly the northern portion of the site and the adjacent State property, was probably once cultivated with sugar cane, but there is no sign of this cultivation or the sugar cane at the present time. The dominant plant species in this type of vegetation, especially along roadsides, include *Atriplex semibaccata* (Australian saltbush), swollen fingergrass (*Chloris barbata*), weedy heliotrope (*Heliotropium procumbens*), *Sida ciliaris* (no common name), and Dahlberg daisy (*Dyssodia tenuiloba*), and lesser amounts of other weedy species.

(2) Buffel Grass Grassland

This is a heterogeneous assemblage of subtypes united by the dominance of Buffel grass (*Cenchrus ciliaris*) as the ground cover. It was described as "Fallowed Fields Mixed Herb Associations" by Nagata (1996), and "mixed grass shrubland" by Char and Associates (1997b), and is the category recognized in the most recent botanical survey of the site (Whistler 2007). No other herbaceous species approaches the dominance of Buffel grass in this vegetation. In some places it is almost entirely this species, but in others it is mixed with lesser amounts of alien weedy species, particularly partridge pea (*Chamaecrista nictitans*), golden crown-beard (*Verbesina encelioides*), Guinea grass (*Panicum maximum*), fuzzy rattlepod (*Crotalaria incana*), and wild bushbean (*Macroptilium atropurpureum*), and the common native ʻuhaloa (*Waltheria indica*). In other places, scattered individuals of the trees koa haole (*Leucaena leucocephala*), kiawe (*Prosopis pallida*), and ʻopiuma (*Pithecellobium dulce*) are present (Fig. 5). The State property to the east of the Debartolo property is also covered with a dense matrix of Buffel grass, mixed with lesser amounts of other herbaceous species. A single shrub of the endangered koʻoloaʻula was found here during the 2007 survey, but it was not seen during the present survey and in any case was not within the 200 ft wide zone studied this time.

THE FLORA

Sixty-seven plant species were recorded at the study site (see Appendix 1) during the present survey. This included 19 species not found during the previous survey (Whistler 2007), but ten species found during that earlier survey were not found this time. Only six of the 77 species found during the two surveys are native, five of them indigenous, one endemic. Indigenous plants are species native to a region or place, but are also found elsewhere. Endemic plants are species restricted to a single region or area, i.e., in the case of Hawai‘i, they are found only in Hawai‘i. In biodiversity terms, the endemic status is the more important of the two categories, since if a species belonging to it is endangered or threatened in Hawai‘i, it would likewise be classified globally. Indigenous species, however, can be rare in Hawai‘i, but may be common elsewhere in the Pacific. Over 90% of the native plants in Hawai‘i are endemic, one of the highest rates in the world. The majority of the 67 species encountered during the survey are naturalized or weedy “alien” plants that were accidentally or intentionally introduced to Hawai‘i, but which have now become established in the islands and can spread on their own.

All five of the indigenous species found during the two surveys are common or occasional species. Two of them, ‘uhaloa (*Waltheria indica*) and ‘ilima (*Sida fallax*), are widespread species common in disturbed habitats in Hawai‘i. The third, *Jacquemontia ovalifolia* (pa‘u-o-Hi‘i‘aka), is found in the Caribbean in addition to Hawai‘i. The fourth, hoary abutilon (*Abutilon incanum*), is occasional, but is only questionably native in Hawai‘i. The fifth, alena (*Boerhavia repens*), was not found during the present survey, but is common in Hawai‘i. The endemic species, ko‘oloa‘ula (*Abutilon menziesii*), is a federally listed endangered species, but it was not found on the site during the present survey.

The previous survey was conducted during a dry summer (August 2007) in an exceptional drought year. Although the present survey was also conducted during the dry season, this year so far has 50% above the average rainfall, and the last two months (May and June) have had four times the normal rainfall for this period. This has resulted in an unusually verdant lowland condition for this time of year. This probably accounts for the number of new species recorded for the site (19).

DISCUSSION

The study was conducted in June 2011. Two types of vegetation can be recognized at the site: Managed Land Vegetation and Buffel Grass Grassland. Both of these are heavily disturbed. The latter is heterogeneous, with subtypes most notably recognized by the presence or absence of trees or shrubs in the matrix of Buffel grass. No native vegetation is present due to the decades of sugar cane cultivation. Likewise, no wetlands were found, since the area is so dry and the soil unsuitable for this kind of vegetation.

Sixty-seven plant species were found during the survey, four of them indigenous: ‘ilima (*Sida fallax*), ‘uhaloa (*Waltheria indica*), pa‘u-o-Hi‘i‘aka (*Jacquemontia ovalifolia*), and ma‘o (*Abutilon incanum*). The first three are common in Hawai‘i, often in disturbed places, the latter is occasional (and is questionably native). Only two other indigenous species have been reported from the area during previous surveys, popolo (*Solanum americanum*) and alena (*Boerhavia repens*). Both are widespread and common indigenous plants in Hawai‘i. Ten other species found during the previous survey (Whistler 2007) were not found during the present one, but all except one of these are weedy alien species that were listed as “uncommon” in the 2007 report.

One endangered species was found in the area during previous surveys, ko‘oloa‘ula (*Abutilon menziesii*). Ko‘oloa‘ula is a much-branched shrub belonging to the mallow family Malvaceae. It is now rare in the lowlands of Hawai‘i, and was listed as Endangered in 1986 (Federal Register 1986). Prior to 1996, only a few plants had been found on O‘ahu, but in that year a population of 38 individuals was discovered in abandoned sugar cane fields (Nagata 1996). A later survey after a period of heavy rain recorded 88 individuals (Char and Associates 1997a). A single individual was found during the 2007 survey about 270 feet east of the western boundary of the State property, and is apparently the same individual recorded by Char and Associates (2003) at “location no. 5.” If it still exists, it was not seen during the present survey, and in any case, it was east of the present study area.

The present survey was carried out in the dry season, but this has been a very wet year and it is unlikely that more species would be found during a wet season survey. Any additional species would most likely be alien weeds in any case.

CONCLUSIONS

Two botanical factors can complicate proposed construction in Hawai‘i. One is the presence of sensitive types of vegetation, the other is the presence of endangered plant species. Sensitive vegetation includes wetlands and native forest. No wetlands or native forests are found in the area, since the topography is not suitable (no basins) and the area is so highly disturbed. Only four native species turned up in the survey, all of them indigenous and none are rare in Hawai‘i. The only plant that could cause any problem is the federally listed ko‘oloa‘ula, but it was not found in the study area during the present survey, nor in any previous survey.

Consequently, there are no botanical reasons why development of the parcel cannot take place. This includes the main parcel and the 200 ft wide strip of State land. All of the proposed development is on very disturbed land.

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APPENDIX 1. PLANT SPECIES CHECKLIST

The following is a checklist of the vascular plants inventoried during the field study at the Debartolo and adjacent State properties during the 2011 survey. The plants are divided into two groups, Monocots, and Dicots. Within these groups, the species are presented taxonomically by family, with each family and each species in the family in alphabetical order. The taxonomy and nomenclature follow Wagner *et al*. (1999). In most cases, common English and/or Hawaiian names listed here have been taken from St. John (1973) or Porter (1972).

For each species, the following information is provided:

1. Scientific name with author citation.
2. Common English and/or Hawaiian name, when known.
3. Biogeographic status. The following symbols are used.
   - E = endemic (found only in Hawai‘i).
   - I = indigenous (native to Hawai‘i as well as other geographic areas).
   - P = Polynesian introduction (introduced to Hawai‘i by Polynesians before the advent of the Europeans).
   - X = Introduced or alien (not native, introduced to Hawai‘i, either accidentally or intentionally, after the advent of the Europeans).
4. Relative frequency (abundant, locally abundant, common, locally common, occasional, uncommon, rare).

* Indicates new species not recorded during the 2007 survey.

Species	Common Names	Status	Abundance
MONOCOTS			
POACEAE (Grass Family)			
Cenchrus ciliaris L.	Buffel grass	X	abundant
**Cenchrus echinatus* L.	sandbur	X	uncommon
Chloris barbata (L.) Sw.	swollen fingergrass	X	common
Cynodon dactylon (L.) Pers.	Bermuda grass	X	locally common
**Dactyloctenium aegyptium* (L.) Willd.	beach wiregrass	X	uncommon
**Digitaria* cf. *violascens* Link	violet crabgrass	X	rare
Eragrostis cf. *cilianensis* (All.) Link	stink grass	X	
Panicum maximum Jacq.	Guinea grass	X	occasional
Rhynchelytrum repens (Willd.) C.E. Hubb.	Natal redtop	X	uncommon
**Setaria verticillata* (L.) P. Beauv.	bristly foxtail	X	locally common
DICOTS			
AMARANTHACEAE (Amaranth Family)			
**Achyranthes aspera* L.	----------	X	uncommon
**Amaranthus pungens* Kunth	khaki weed	X	uncommon
Amaranthus spinosus L.	spiny amaranth	X	occasional
**Amaranthus viridis* L.	slender amaranth	X	rare
ANACARDIACEAE (Mango Family)			
Schinus terebinthifolius Raddi	Christmas berry	X	not found 2011
AIZOACEAE (Carpetweed Family)			
Tetragonia tetragonioides (Pall.) Kuntze	New Zealand spinach	X	uncommon
ASTERACEAE (Sunflower Family)			
**Bidens pilosa* L.	beggar’s-tick	X	uncommon
Conyza bonariensis (L.) Cronq.	hairy horseweed	X	occasional

Species	Common Names	Status	Abundance
ASTERACEAE (cont'd.)			
Dyssodia tenuiloba A.P. de Candolle	Dahlberg daisy	X	locally common
**Emilia fosbergii* Nicolson	red pualele, emilia	X	uncommon
**Lactuca serriola* L.	prickly lettuce	X	occasional
Pluchea carolinensis (Jacq.) G. Don	pluchea	X	common
Pluchea xfosbergii Cooperr. & Galang	hybrid pluchea	X	not found 2011
Pluchea indica (L.) Less.	Indian pluchea	X	not found 2011
Sonchus oleraceus L.	sow thistle	X	occasional
Tridax procumbens L.	coat buttons	X	occasional
Verbesina encelioides (Cav.) Benth. & Hook.	golden crownbeard	X	common
**Xanthium strumarium* L.	cocklebur	X	uncommon
BIGNONIACEAE (Bignonia Family)			
Spathodea campanulata P. Beauv.	African tulip tree	X	uncommon
BORAGINACEAE (Heliotrope Family)			
Cordia dichotoma Forst. f.	sebestan	X	occasional
Heliotropium procumbens Mill.	weedy heliotrope	X	locally common
BRASSICACEAE (Mustard Family)			
**Lepidium virginicum* L.	wild peppergrass	X	uncommon
CHENOPODIACEAE (Goosefoot Family)			
Atriplex semibaccata R. Br.	Australian saltbush	X	common
Atriplex subrecta Verd.	----------	X	not found 2011
Salsola kali L.	Russian thistle	X	not found 2011
CONVOLVULACEAE (Morning-Glory Family)			
Ipomoea obscura (L.) Ker-Gawl.	bindweed	X	occasional
**Ipomoea triloba* L.	pink bindweed	X	uncommon
**Jacquemontia ovalifolia* (Choisy) H. Hall.	pa'u-o-Hi'i'aka	I	rare
Merremia aegyptia (L.) Urb.	hairy merremia	X	occasional
CUCURBITACEAE (Gourd Family)			
Coccinea grandis (L.) Voigt	ivy gourd	X	rare
Cucumis dipsaceus Ehrenb. ex Spach	wild cucumber	X	occasional
Momordica charantia L.	wild bittermelon	X	uncommon
EUPHORBIACEAE (Spurge Family)			
Chamaesyce hirta (L.) Millsp.	garden spurge	X	common
Chamaesyce hypericifolia (L.) Millsp.	graceful spurge	X	common
**Chamaesyce prostrata* (Aiton) Small	prostrate spurge	X	occasional
Ricinus communis L.	castor bean	X	occasional
FABACEAE (Pea Family)			
Acacia confusa Merr.	Formosan koa	X	not found 2011
Acacia farnesiana (L.) Willd.	klu	X	rare
Chamaecrista nictitans (L.) Moench	partridge pea, lau-ki	X	locally common

Species	Common Names	Status	Abundance
FABACEAE (cont'd.)			
Crotalaria incana L.	fuzzy rattlepod	X	common
**Crotalaria pallida* Aiton	smooth rattlepod	X	uncommon
Desmanthus pernambucanus (L.) Thellung	virgate mimosa	X	common
Desmodium tortuosum (Sw.) DC.	Florida beggarweed	X	occasional
Indigofera spicata Forssk.	creeping indigo	X	locally common
Indigofera suffruticosa Mill.	indigo, 'iniko	X	occasional
Leucaena leucocephala (Lam.) de Wit	koa haole	X	common
Macroptilium atropurpureum (DC) Urb.	wild bushbean	X	locally common
Medicago polymorpha L.	bur clover	X	not found 2011
Pithecellobium dulce (Roxb.) Benth.	'opiuma, Manila tamarind	X	locally common
Prosopis pallida (Humb. & Bonpl. ex Willd.) Kunth	kiawe, mesquite	X	occasional
Samanea saman (Jacq.) Merr.	monkeypod	X	not found 2011
LAMIACEAE (Mint Family)			
Leonotis nepetifolia (L.) R. Br.	orange lion's-ear	X	occasional
MALVACEAE (Mallow Family)			
Abutilon grandifolium (Willd.) Sweet	hairy abutilon	X	uncommon
Abutilon incanum (Link) Sweet	ma'o, hoary abutilon	I?	uncommon
Abutilon menziesii Seem.	ko'oloa 'ula	E	not found 2011
**Malvastrum coromandelianum* (L.) Garcke	false mallow	X	occasional
Sida ciliaris L.	----------	X	locally common
Sida fallax Walp.	'ilima	I	occasional
Sida rhombifolia L.	Cuba jute	X	uncommon
Sida spinosa L.	prickly sida	X	locally common
NYCTAGINACEAE (Four-o'-Clock Family)			
Boerhavia repens R. Br.	alena, nena	I	not found 2011
PASSIFLORACEAE (Passionflower Family)			
Passiflora foetida L.	love-in-a-mist	X	uncommon
SOLANACEAE (Nightshade Family)			
Datura stramonium L.	Jimson weed	X	uncommon
**Lycopersicon pimpinellifolium* (Jusl.) Mill.	currant tomato	X	common
Nicotiana glauca R. C. Graham	tree tobacco	X	occasional
STERCULIACEAE (Cacao Family)			
Waltheria indica L.	'uhaloa	I	common
VERBENACEAE (Verbena Family)			
**Stachytarpheta jamaicensis* (L.) Vahl	Jamaica vervain, oi, owi	X	occasional