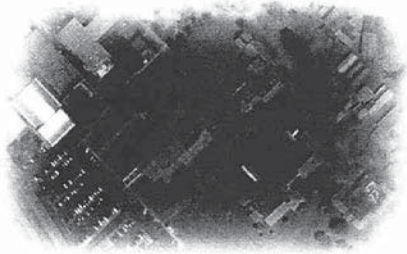


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Traffic Impact Report

Kauai Community College Redesignation to Urban District



Prepared for:
University of Hawaii

Prepared by:
Wilson Okamoto Corporation

December 2010

TRAFFIC IMPACT REPORT FOR THE KAUAI COMMUNITY COLLEGE REDESIGNATION TO URBAN DISTRICT

Prepared for:

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December 2010

Traffic Impact Report for Kauai Community College

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I. INTRODUCTION

A. Purpose of Study

The purpose of this study is to identify and assess the traffic impacts resulting from the implementation of Kauai Community College's Long Range Development Plan (LRDP). The LRDP includes construction of new facilities at the community college to expand existing programs.

B. Scope of Study

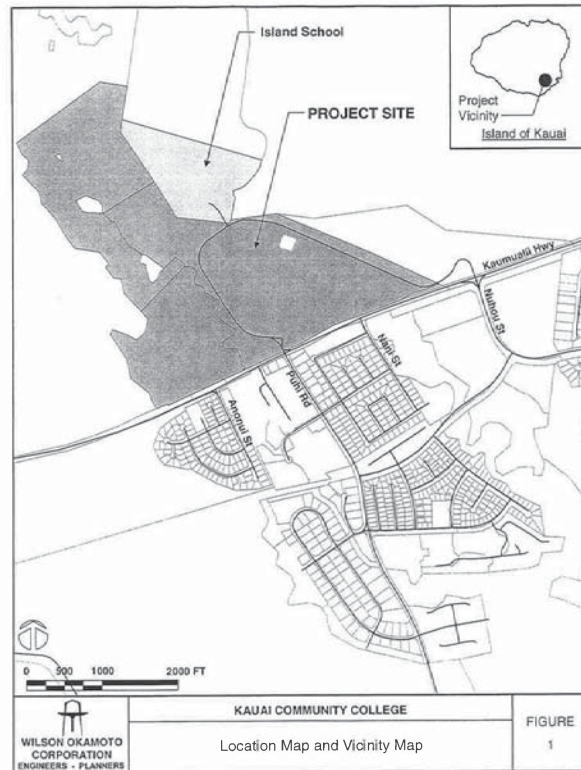
This report presents the findings and conclusions of the traffic study, the scope of which includes:

1. Description of the proposed project.
2. Evaluation of existing roadway and traffic operations in the vicinity.
3. Analysis of future roadway and traffic conditions without the proposed project.
4. Analysis and development of trip generation characteristics for the proposed project.
5. Superimposing site-generated traffic over future traffic conditions.
6. The identification and analysis of traffic impacts resulting from the proposed project.
7. Recommendations of improvements, if appropriate, that would mitigate the traffic impacts resulting from the proposed project.

II. PROJECT DESCRIPTION

A. Location

Kauai Community College (KCC) is located adjacent to Kaumualii Highway in Puihi on the island of Kauai, and is further identified as Tax Map Keys: 3-4-07:01, 02, 03, and 06 (see Figure 1). The project site is bounded by agricultural uses to the west and north, Island School and Gaylord's Restaurant to the east, and Kaumualii Highway to the south. Primary access to the community college is provided via an access road at the intersection of Kaumualii Highway with Puihi Road while secondary access is provided via an access road at the intersection of Kaumualii Highway with Nuhou Street.



B. Project Characteristics

Kauai Community College's Long-Range Development Plan (LRDP) includes the construction of a number of new facilities to allow the expansion of existing programs. The LRDP site plan shown in Figure 2 outlines the proposed expansion areas by the following programs:

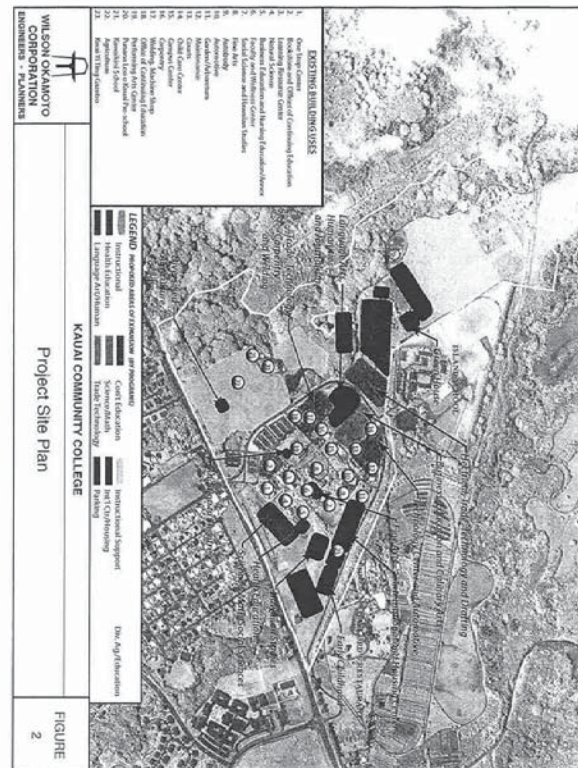
- Business, education, and culinary arts
- Health education and early childhood studies
- Language arts, humanities, and journalism (including Hawaiian studies and fine arts)
- Science, math, and social sciences
- Trade technology (including carpentry, welding, as well as, electrical, and automotive trades)
- International and Housing Center
- Diversified agriculture/education

In addition, the LRDP includes the expansion of existing parking areas. The implementation schedule for the LRDP is not known at this time. However, for the purpose of this report and consistency with the implementation of the master plan for the adjacent Island School, the implementation of the LRDP is assumed to be completed by the Year 2020.

III. EXISTING TRAFFIC CONDITIONS

A. Area Roadway System

The primary access for KCC is provided via an access road at the intersection of Kaumualii Highway and Puihi Road. In the vicinity of the community college, Kaumualii Highway is a predominantly two-lane, two-way roadway generally oriented in the east-west direction. At the signalized intersection with Puihi Road, both approaches of Kaumualii Highway have exclusive turning lanes and one through lane. Puihi Road is a predominantly two-lane, two-way roadway generally oriented in the north-south direction. At the intersection with Kaumualii Highway, the northbound approach of Puihi Road has a shared left-turn and through lane, and an exclusive right-turn lane. The southbound approach of the intersection is comprised of the access road for the community college which has a shared left-turn and through lane, and an exclusive right-turn lane. An additional westbound departure lane is



provided along Kaumualii Highway at this intersection to allow southbound right-turning vehicles to proceed freely through the intersection.

Northeast of the intersection with Puhi Road, Kaumualii Highway intersects Nani Street. At this unsignalized T-intersection, the eastbound approach of the highway has one lane that serves through and right-turn traffic movements while the westbound approach has one lane that serves left-turn and through traffic movements. Nani Street is a two-lane, two-way roadway generally oriented in the north-south direction. At the intersection with the highway, the Nani Street approach has one lane that serves left-turn and right-turn traffic movements.

Further northeast, Kaumualii Highway intersects Nuhou Street. At this signalized intersection, the eastbound approach of the highway has exclusive turning lanes and one through lane while the westbound approach has one through lane and a shared through and right-turn lane. Nuhou Street is a four-lane, two-way roadway generally oriented in the north-south direction. At the intersection with the highway, the northbound approach of Nuhou Street has a shared left-turn and through lane, and an exclusive right-turn lane. The southbound approach of the intersection is comprised of the secondary access for KCC which has one lane that serves all traffic movements.

B. Traffic Volumes and Conditions

1. General

a. Field Investigation

Field investigations were conducted on September 14-16, 2010 and consisted of manual turning movement count surveys during the morning peak hours between 6:00 AM and 9:00 AM, and the afternoon peak hours between 3:00 PM and 6:00 PM at the following intersections:

- Kaumualii Highway and Puhi Road
- Kaumualii Highway and Nani Street
- Kaumualii Highway and Nuhou Street

In addition, a 24-hour mechanical count survey was conducted along the main access for KCC north of the Kaumualii Highway and Puhi Road intersection. Appendix A includes the existing traffic count data.

b. Capacity Analysis Methodology

The highway capacity analysis performed in this study is based upon procedures presented in the "Highway Capacity Manual", Transportation Research Board, 2000, and the "Synchro" software developed by Trafficware. The analysis is based on the concept of Level of Service (LOS) to identify the traffic impacts associated with traffic demands during the peak hours of traffic.

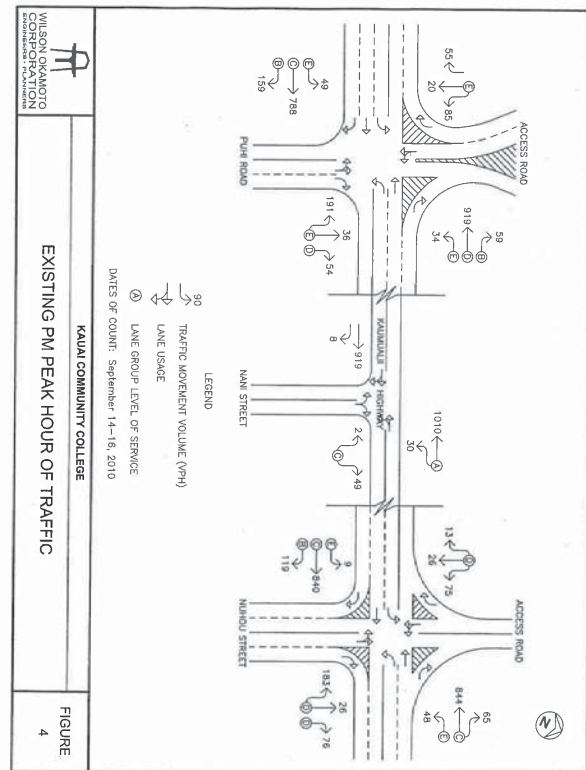
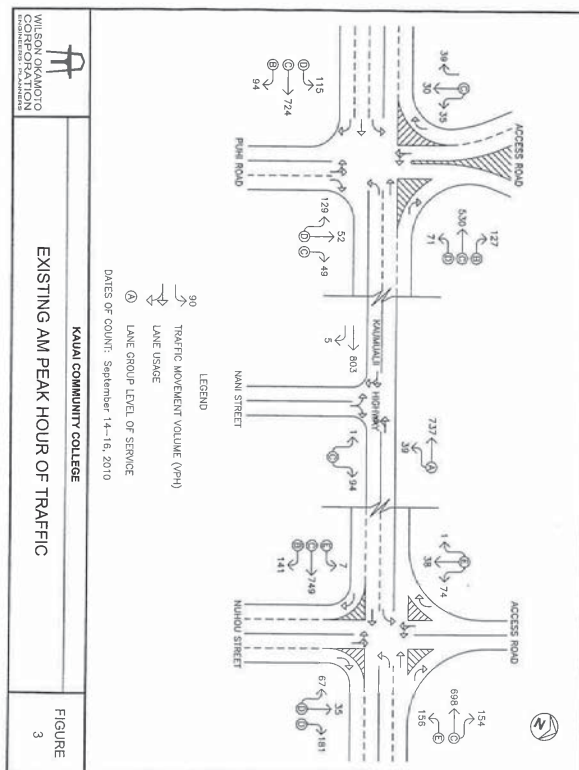
LOS is a quantitative and qualitative assessment of traffic operations. Levels of Service are defined by LOS "A" through "F"; LOS "A" representing ideal or free-flow traffic operating conditions and LOS "F" unacceptable or potentially congested traffic operating conditions.

"Volume-to-Capacity" (v/c) ratio is another measure indicating the relative traffic demand to the road carrying capacity. A v/c ratio of one (1.00) indicates that the roadway is operating at or near capacity. A v/c ratio of greater than 1.00 indicates that the traffic demand exceeds the road's carrying capacity. The LOS definitions are included in Appendix B.

2. Existing Peak Hour Traffic

a. General

Figures 3 and 4 show the existing AM and PM peak hour traffic volumes and operating traffic conditions in the vicinity of the proposed project. The morning peak hour of traffic generally occurs between 7:15 AM and 8:15 AM in the vicinity of the project. In the afternoon, the peak hour of traffic generally occurs between the hours of 4:00 PM and 5:00 PM. The analysis is based on these commuter



peak hour time periods to identify the traffic impacts resulting from the proposed project. LOS calculations are included in Appendix C.

b. Kaumualii Highway and Puhi Road

At the intersection with Puhi Road, Kaumualii Highway carries 933 vehicles eastbound and 728 vehicles westbound during the AM peak period. During the PM peak period, traffic volumes are higher with 996 vehicles traveling eastbound and 1,012 vehicles traveling westbound. The left-turn traffic movement on both approaches of the highway operate at LOS "D" and LOS "E" during the AM and PM peak periods, respectively, while the right-turn traffic movements operate at LOS "B" during both peak periods. The eastbound through traffic movement operates at LOS "C" during both peak periods while the westbound through traffic movement operates at LOS "C" and LOS "D" during the AM and PM peak periods, respectively. Traffic queues periodically formed on the eastbound and westbound approaches of the intersection with average queue lengths of 10-12 vehicles observed on both approaches during both peak periods. These queues were observed to clear the intersection after each traffic signal cycle change.

The Puhi Road approach of the intersection carries 230 vehicles and 281 vehicles northbound during the AM and PM peak periods, respectively. The northbound left-turn and through traffic movement on this approach operates at LOS "D" and LOS "E" during the AM and PM peak periods, respectively, while the right-turn traffic movement operates at LOS "C" and LOS "D" during the AM and PM peak periods, respectively. Traffic queues periodically formed on the Puhi Road approach of the intersection with average queue lengths of 9-11 vehicles observed during both peak periods. These queues were observed to clear the intersection after each traffic signal cycle change.

The southbound approach of the intersection is comprised of the access road for KCC which carries 104 vehicles and 160 vehicles southbound during the AM and PM peak periods, respectively. The southbound left-turn and through traffic movement on this approach operates at LOS "C" and LOS "E" during the AM and PM peak periods, respectively. Traffic queues periodically formed on the access road approach of the intersection with average queue lengths of 2-3 vehicles observed during both peak periods. These queues were observed to clear the intersection after each traffic signal cycle change.

c. Kaumualii Highway and Nani Street

At the intersection with Nani Street, Kaumualii Highway carries 808 vehicles eastbound and 766 vehicles westbound during the AM peak period. During the PM peak period, traffic volumes are higher with 927 vehicles traveling eastbound and 1,040 vehicles traveling westbound. The critical traffic movement along the highway at this intersection is the westbound approach which operates at LOS "A" during both peak periods.

The Nani Street approach of the intersection carries 95 vehicles and 51 vehicles northbound during the AM and PM peak periods, respectively. Traffic queues periodically formed on the Nani Street approach of the intersection with average queue lengths of 1-3 vehicles observed during both peak periods.

d. Kaumualii Highway and Nuhou Street

At the intersection with Nuhou Street, Kaumualii Highway carries 897 vehicles eastbound and 1,008 vehicles westbound during the AM peak period. During the PM peak period, the overall traffic volume is approximately the same with 968 vehicles traveling eastbound and 957 vehicles traveling westbound. The left-turn traffic movement on both approaches of the highway operate LOS "E" during both peak periods while the eastbound through and westbound through

and right-turn traffic movements operate at LOS "C" during both peak periods. The eastbound right-turn traffic movement along the highway operates at LOS "B" during both peak periods. Traffic queues periodically formed on the eastbound and westbound approaches of the intersection with the most significant queuing occurring on the eastbound approach of the intersection. Queue lengths in excess of 15 vehicles were observed on the eastbound approach during this peak period. Most of these queues cleared after each traffic signal cycle change, but occasionally vehicles had to wait for more than one traffic signal cycle length.

The Nuhou Street approach of the intersection carries 283 vehicles and 285 vehicles northbound during the AM and PM peak periods, respectively. The traffic movements on this approach operate at LOS "D" during both peak periods. Traffic queues periodically formed on the Puhi Road approach of the intersection with the most significant queuing occurring during the PM peak period. Average queue lengths of 10-12 vehicles were observed during this peak period with these queues observed to clear the intersection after each traffic signal cycle change.

The southbound approach of the intersection is comprised of the access road for KCC which carries 113 vehicles and 114 vehicles southbound during the AM and PM peak periods, respectively. This approach operates at LOS "E" and LOS "D" during the AM and PM peak periods, respectively. Traffic queues periodically formed on the access road approach of the intersection with average queue lengths of 1-3 vehicles observed during both peak periods. These queues were observed to clear the intersection after each traffic signal cycle change.

IV. PROJECTED TRAFFIC CONDITIONS

A. Site-Generated Traffic

1. Trip Generation Methodology

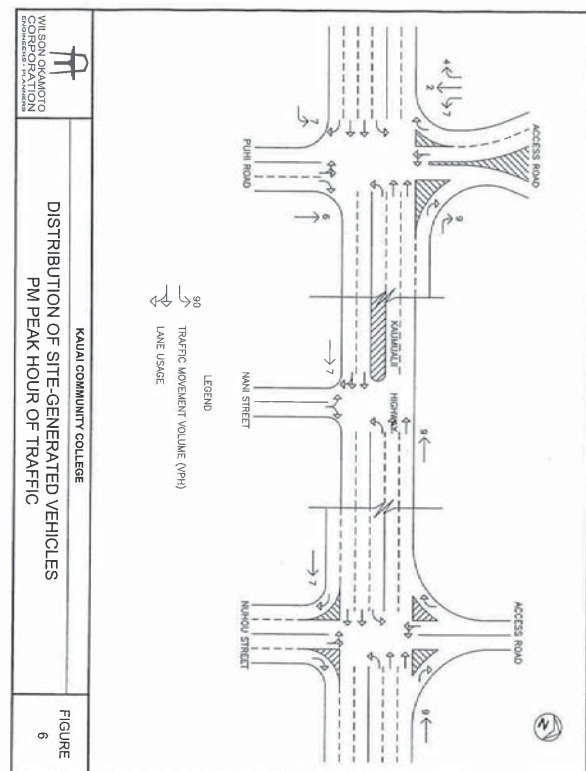
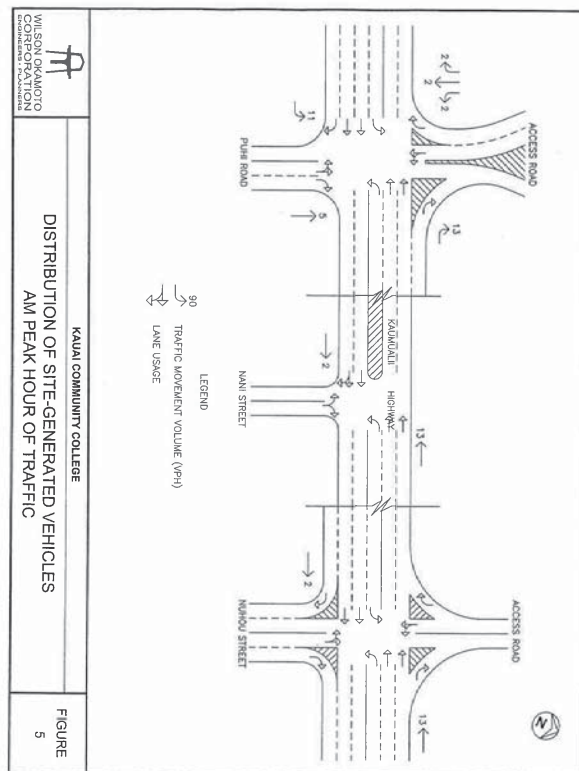
The trip generation methodology used in this study is based upon generally accepted techniques developed by the Institute of Transportation Engineers (ITE) and published in "Trip Generation, 8th Edition," 2008. The ITE trip generation rates are developed empirically by correlating the vehicle trip generation data with various land use characteristics such as the number of vehicle trips generated per student. The LRDP entails the development of new facilities that will allow the expansion of existing programs at the college. In conjunction with the expansion of these programs, enrollment at KCC is expected to increase. Enrollment projections published by the University of Hawaii for KCC currently extend only to 2015. However, in coordination with KCC and utilizing standard linear regression techniques, the enrollment projections were extended to 2020 (see Appendix D) when the full-time equivalent (FTE) course enrollment at KCC is expected to increase from 864 students to 1,038 students. Table 1 summarizes the project site trip generation characteristics applied to the AM and PM peak hours of traffic.

Table 1: Peak Hour Trip Generation

JUNIOR/COMMUNITY COLLEGE		
INDEPENDENT VARIABLE:		Increase in FTE enroll = 174 students
AM PEAK	ENTER	29
	EXIT	6
	TOTAL	35
PM PEAK	ENTER	22
	EXIT	13
	TOTAL	35

2. Trip Distribution

Figures 5 and 6 show the distribution of site-generated vehicular trips at the study intersections during the AM and PM peak hours of traffic.



Primary access to Kauai Community College will continue to be provided via the intersection of Kaumualii Highway and Puhi Road with secondary access provided via the intersection of Kaumualii Highway and Nuhou Street. For the purpose of this report, all new trips generated by the community college are conservatively assumed to utilize the primary access since most of the on-campus parking is provided off this roadway. At the intersection of Kaumualii Highway and Puhi Road, the directional distribution of site-generated vehicles is assumed to remain similar to existing conditions. At the other study intersection, all site-generated vehicles are assumed to continue through the intersections to travel to/from the community college.

B. Through Traffic Forecasting Methodology

The travel forecast is based upon historical traffic count data obtained from the State Department of Transportation (SDOT), Highway Division survey stations in the vicinity of the project site. The historical data indicates a stable or declining growth in traffic and, as such, an annual traffic growth rate of approximately 0.5% per year was conservatively assumed along Kaumualii Highway in the project vicinity. Using 2010 as the Base Year, a growth factor of 1.05 was applied to the existing through traffic demands along Kaumualii Highway achieve the projected Year 2020 traffic demands.

C. Other Considerations

1. Island School

Island School is a private Pre-K through 12th grade school located adjacent to Kauai Community College in Puhi on the island of Kauai. The school has a master plan that entails the expansion its campus over the next 10 years to provide additional classrooms and facilities. During this development period, enrollment at the school is expected to increase from the current enrollment of 360 students to an enrollment of 500 students. As described in the "Traffic Impact Report for the Island School Master Plan" dated December 2010, the increase in enrollment at the school is expected to result in approximately 113 new trips during the AM peak period and 24 new trips

during the PM peak period. These trips were assigned to the street network in the study area in the Year 2020 without project scenario to account for new trips generated the implementation of the Island School master plan.

2. Kaumualii Highway Widening

The State of Hawaii Department of Transportation is currently widening Kaumualii Highway from a two-lane undivided highway to a four-lane divided highway between Anonui Road and the Lihue Mill Bridge. The highway will have two travel lanes in each direction with auxiliary lanes provided at the intersections along this segment once construction is completed near the end of 2012.

D. Total Traffic Volumes Without Project

The projected Year 2020 AM and PM peak hour traffic volumes and operating conditions without the implementation of Kauai Community College's Long Range Development Plan are shown on Figures 7 and 8, and summarized in Table 2. Kaumualii Highway is assumed to be widened to a four-lane divided highway by the Year 2020 with a westbound left-turn bay provided at the intersection with Nani Street. The existing levels of service are provided for comparison purposes. LOS calculations are included in Appendix E.

Table 2: Existing and Projected Year 2020 (Without Project) Traffic Operating Conditions

Intersection	Critical Traffic Movement	AM		PM	
		Exist	Year 2020 w/out Proj	Exist	Year 2020 w/out Proj
Kaumualii Hwy/ Puhi Rd	Eastbound	LT	D	E	D
		TH	C	B	C
		RT	B	B	B
	Westbound	LT	D	C	E
		TH	C	B	D
		RT	B	B	B
	Northbound	L-T-TH	D	C	E
		RT	C	B	D
	Southbound	L-T-TH	C	C	E
		RT	-	B	-

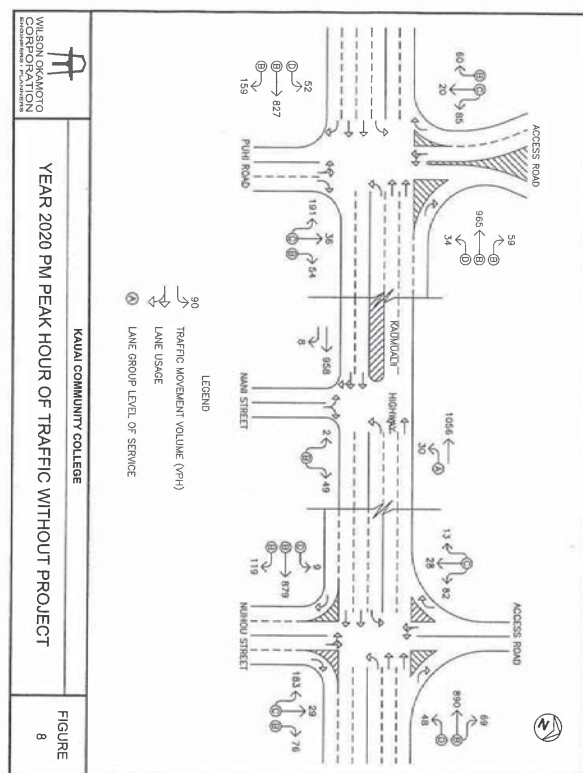
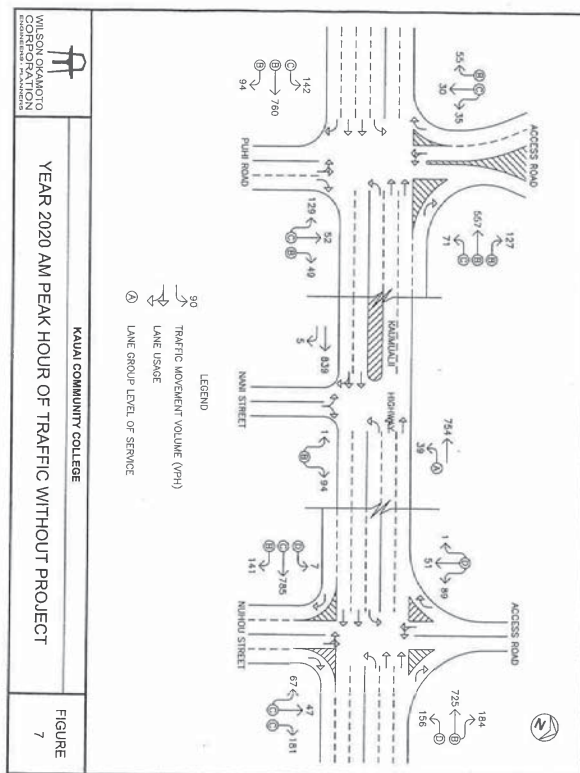


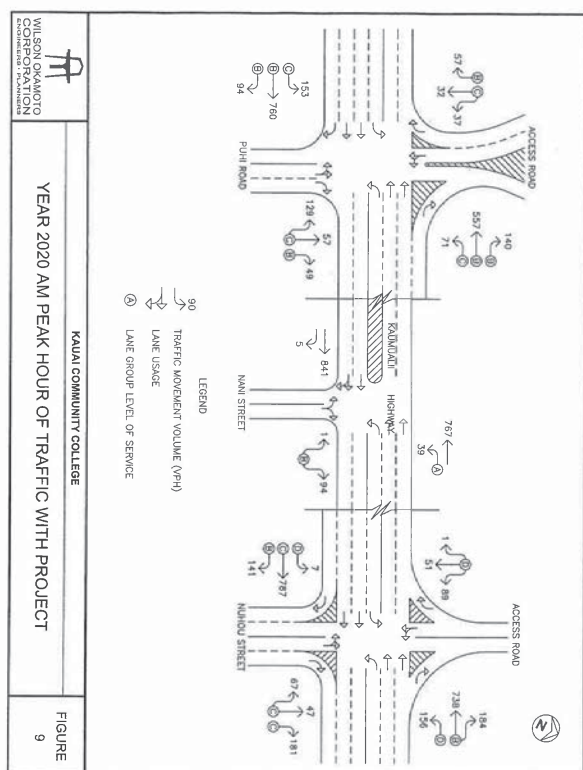
Table 2: Existing and Projected Year 2020 (Without Project) Traffic Operating Conditions (Cont'd)

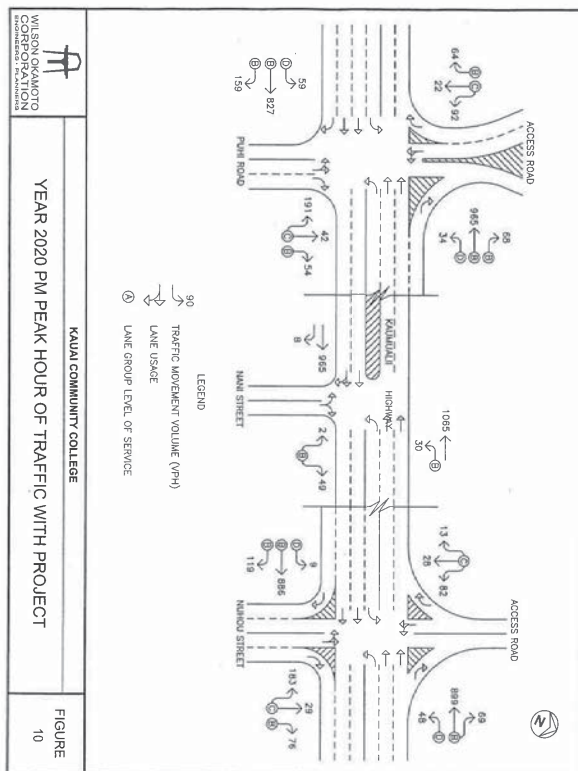
Intersection	Critical Traffic Movement	AM		PM	
		Exist	Year 2020 w/out Proj	Exist	Year 2020 w/out Proj
Kaumualii Hwy/ Nani St	Westbound	LT	A	A	A
	Northbound	LT-RT	C	B	C
Kaumualii Hwy/ Nuhou St	Eastbound	LT	E	D	E
	Westbound	LT	E	D	E
Kaumualii Hwy/ Nuhou St	Northbound	LT	E	D	E
	Southbound	LT-TH-RT	E	D	C

Traffic operations in the vicinity of KCC without the implementation of their LRDP are expected to improve during both peak hours of traffic due to the widening of Kaumualii Highway to a four-lane divided highway. The traffic movements at the intersection of Kaumualii Highway with Puhi Road are expected to operate at LOS "C" or better during the AM peak period and LOS "D" or better during the PM peak period while those at the intersection with Nani Street are expected to operate at LOS "B" or better during both peak periods. At the intersection with Nuhou Street, the traffic movements are expected to operate at LOS "D" or better during both peak periods.

E. Total Traffic Volumes With Project

Figures 9 and 10 show the projected Year 2020 cumulative AM and PM peak hour traffic conditions resulting from the implementation of the Long Range Development Plan for Kauai Community College. The cumulative volumes consist of site-generated traffic superimposed over Year 2020 projected traffic demands. The traffic impacts resulting from the proposed project are addressed in the following section.





YEAR 2020 PM PEAK HOUR OF TRAFFIC WITH PROJECT

FIGURE 10

V. TRAFFIC IMPACT ANALYSIS

The Year 2020 cumulative AM and PM peak hour traffic conditions with the implementation of Kauai Community College's Long Range Development Plan are summarized in Table 3. The projected Year 2020 operating conditions without the proposed project are provided for comparison purposes. LOS calculations are included in Appendix F.

Table 3: Projected Year 2020 (Without and With Project) Traffic Operation Conditions

Intersection	Critical Traffic Movement	AM		PM	
		Year 2020 w/out Proj	Year 2020 w/ Proj	Year 2020 w/out Proj	Year 2020 w/ Proj
Kaumualii Hwy/Puhi Rd	Eastbound	LT	C	C	D
		TH	B	B	B
		RT	B	B	B
	Westbound	LT	C	C	D
		TH	B	B	B
		RT	B	B	B
	Northbound	LT-TH	C	C	C
		RT	B	B	B
	Southbound	LT-TH	C	C	C
		RT	B	B	B
Kaumualii Hwy/Nani St	Westbound	LT	A	A	A
	Northbound	LT-RT	B	B	B
Kaumualii Hwy/Nuhou St	Eastbound	LT	D	D	D
		TH	C	C	B
		RT	B	B	B
	Westbound	LT	D	D	D
		TH-RT	B	B	B
		RT	C	C	C
	Northbound	LT-TH	C	C	C
		RT	C	C	B
	Southbound	LT-TH-RT	D	D	C

Traffic operations in the vicinity of KCC with the implementation of their LRDP are expected, in general, to operate at levels of service similar to Year 2020 without project conditions despite the addition of site-generated traffic to the surrounding roadways. The westbound left-turn traffic movement along Kaumualii Highway the intersection with Nani Street is expected to operate at a slightly lower level of service during the PM peak period.

The remaining critical movements at this intersection, as well as, the other study intersections are expected to continue operating at levels of service similar to without project conditions. In addition, the total traffic volumes entering the study intersections are expected to increase by less than 2% during both peak periods with the proposed project. These increases in the total traffic volumes are in the range of daily volume fluctuations along Kaumualii Highway and represent a minimal increase in the overall traffic volumes.

VI. RECOMMENDATIONS

Based on the analysis of the traffic data, the following are the recommendations of this study associated with the project:

1. Maintain sufficient sight distance for motorists to safely enter and exit all project roadways.
2. Maintain adequate on-site loading and off-loading service areas and prohibit off-site loading operations.
3. Maintain adequate turn-around area for service, delivery, and refuse collection vehicles to maneuver on-site to avoid vehicle-reversing maneuvers onto public roadways.
4. Maintain sufficient turning radii at all project roadways to avoid or minimize vehicle encroachments to oncoming traffic lanes.
5. If the implementation of Kauai Community College's Long Range Development Plan is not completed by the Year 2020, prepare an updated Traffic Impact Report that incorporates a revised project completion year.

VII. CONCLUSION

Kauai Community College's Long-Range Development Plan (LRDP) includes the construction of a number of new facilities to allow the expansion of existing programs. With the implementation of the aforementioned recommendations, the implementation of the LRDP is not expected to have a significant impact on traffic operations in the vicinity. The traffic movements at the study intersections along Kaumualii Highway are expected to continue operating at levels of service similar to without project conditions. In addition, the total traffic volumes entering the study intersections are expected to increase by less than 2% during both peak periods with the proposed project. These increases in the total traffic

volumes are in the range of daily volume fluctuations along Kaumualii Highway and represent a minimal increase in the overall traffic volumes.

Wilson Okamoto Corporation

1907 S. Beretania Street Suite 400
Honolulu, HI 96826

Counter:D4-3890, D4-5677
Counted By:RY, ER
Weather:Clear

File Name : KauPuhi AM
Site Code : 00000001
Start Date : 9/15/2010
Page No : 1

Groups Printed: Unpublished																									
KCC Driveway Southbound					Kauaui Highway Westbound					Pali Street Northbound					Kauaui Highway Eastbound										
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	Int. Total
06:00 AM	2	2	1	0	5	14	89	2	0	115	69	6	6	0	81	2	85	19	2	109	109	2	0	111	237
06:15 AM	1	1	1	0	3	26	151	3	0	210	36	0	4	2	42	9	152	17	2	169	169	0	0	149	376
06:30 AM	1	0	1	0	2	26	169	4	0	199	33	2	11	0	46	8	181	36	0	225	225	0	0	199	413
06:45 AM	3	2	0	0	5	30	126	12	0	170	25	2	3	0	30	9	205	40	0	257	257	0	0	200	418
Total	7	5	3	1	16	96	577	21	0	694	114	4	30	2	150	28	636	112	2	776	776	0	0	679	1437
07:00 AM	1	0	1	0	2	19	92	14	0	124	29	5	3	0	37	15	202	28	6	261	261	0	0	215	414
07:15 AM	8	1	7	0	16	25	149	21	0	195	28	11	19	0	68	18	200	23	3	244	244	0	0	224	513
07:30 AM	8	7	8	0	23	12	131	43	0	165	25	20	5	0	50	62	171	24	6	263	263	0	0	192	410
07:45 AM	14	14	18	0	46	16	126	43	1	186	34	16	9	1	60	35	163	21	4	223	223	0	0	190	398
Total	31	22	34	0	87	71	496	120	1	690	115	52	36	1	205	120	736	96	19	971	971	0	0	822	1637
08:00 AM	5	8	6	3	22	18	123	21	0	162	42	5	15	0	62	10	183	26	3	222	222	0	0	208	406
08:15 AM	7	2	0	0	9	20	126	26	0	172	27	10	13	0	60	16	179	49	1	245	245	0	0	224	417
08:30 AM	10	2	1	0	13	19	132	44	0	165	37	6	24	0	67	23	200	27	8	258	258	0	0	235	449
08:45 AM	7	2	6	0	15	16	121	35	0	159	21	12	23	0	56	24	187	32	9	233	233	0	0	199	406
Total	29	14	13	3	59	73	500	149	0	711	127	23	77	0	237	72	709	134	12	948	948	0	0	874	1697
Grand Total	67	41	50	4	162	240	1577	287	1	2106	357	89	143	3	692	221	2161	343	30	2697	2697	0	0	2375	4766
Approach %	41.4	25.3	30.9	2.5		11.4	74.9	13.6	0		60.3	15	24.2	0.5		8.2	77.9	13.7	1.2		4	37.8	6.2	0.6	48.5
Total %	1.2	0.7	0.9	0.1	2.9	4.3	29.4	5.2	0	37.9	6.4	1.6	2.6	0.1	10.7	4	37.8	6.2	0.6	48.5					

KCC Driveway Southbound													Kauaui Highway Westbound													Pali Street Northbound													Kauaui Highway Eastbound																	Int. Total																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																										
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																															
Peak Hour Analysis From 06:00 AM to 08:45 AM - Peak 1 of 1																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		
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07:15 AM	8	1	7	0	16	25	149	21	0	195	28	11	19	0	68	18	200	23	3	241	241	0	0	223	463	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

APPENDIX A

EXISTING TRAFFIC COUNT DATA

Wilson Okamoto Corporation

1907 S. Beretania Street Suite 400
Honolulu, HI 96826

Counter:D4-5675
Counted By:TO
Weather:Clear

File Name : KauNani AM
Site Code : 00000001
Start Date : 9/15/2010
Page No : 1

Groups Printed: Unpublished																								
Southbound					Kauaui Highway Westbound					Nali Street Eastbound					Kauaui Highway Eastbound									
Start Time	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right
06:00 AM	0	0	0	115	0	0	110	3	0	13	0	10	0	10	0	109	2	0	0	111	109	2	0	111
06:15 AM	0	0	0	210	0	0	213	1	0	11	2	14	0	11	0	149	0	0	0	149	149	0	0	149
06:30 AM	0	0	0	197	0	0	203	1	0	8	2	11	0	11	0	197	2	0	0	199	197	2	0	199
06:45 AM	0	0	0	170	0	0	177	0	0	14	0	14	0	14	0	200	0	0	0	200	200	0	0	200
Total	0	0	0	687	0	0	703	5	0	46	4	55	0	55	0	675	4	0	0	679	679	0	0	679
07:00 AM	0	0	0	127	0	0	137	0	0	19	0	19	0	19	0	213	2	0	0	215	213	2	0	215
07:15 AM	0	0	0	191	0	0	202	0	0	28	0	28	0	28	0	223	0	0	0	223	223	0	0	223
07:30 AM	0	0	0	184	0	0	190	0	0	26	0	26	0	26	0	192	2	0	0	194	192	2	0	194
07:45 AM	0	0	0	178	0	0	188	1	0	19	0	19	0	19	0	190	0	0	0	190	190	0	0	190
Total	0	0	0	680	0	0	717	1	0	92	0	92	0	93	0	818	4	0	0	822	822	0	0	822
08:00 AM	0	0	0	168	0	0	177	0	0	21	0	21	0	21	0	205	3	0	0	208	205	3	0	208
08:15 AM	0	0	0	168	0	0	178	1	0	12	0	13	0	13	0	224	2	0	0	226	224	2	0	226
08:30 AM	0	0	0	192	0	0	197	0	0	17	0	17	0	17	0	235	0	0	0	235	235	0	0	235
08:45 AM	0	0	0	184	0	0	193	1	0	16	0	17	0	17	0	199	0	0	0	199	199	0	0	199
Total	0	0	0	730	0	0	758	3	0	66	0	69	0	69	0	863	11	0	0	874	874	0	0	874
Grand Total	0	0	0	2087	0	0	2175	8	0	204	4	216	0	238	0	2356	19	0	0	2375	2375	0	0	2375
Approach %	0	0	0	90	0	0	45.8	3.7	0	94.4	1.9	4.5	0	98.2	0.8	0	4	37.8	6.2	0.6	48.5			
Total %	0	0	0	1.6	43.8	0	45.8	0.2	0	4.3	0.1	4.5	0	49.4	0.4	49.4	0.4	0	49.8					

Grouped Printed: Unpublished																									
Southbound					Kauaui Highway Westbound					Pali Street Northbound					Kauaui Highway Eastbound										Int. Total
Start Time	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	
Peak Hour Analysis from 08:00 AM to 08:45 AM - Peak 1 of 1																									
Peak Hour for Entire Intersection Begins at 08:00 AM																									
08:00 AM	0	11	168	0	177	0	0	31	21	0	205	3	208	0	205	3	208	0	205	3	208	0	205	3	
08:15 AM	0	10	168	0	178	1	0	12	13	0	224	2	226	0	224	2	226	0	224	2	226	0	224	2	
08:30 AM	0	1	192	0	193	1	0	15	16	0	235	0	235	0	235	0	235	0	235	0	235	0	235	0	
08:45 AM	0	3	184	0	263	1	0	18	17	0	199	6	205	0	199	6	205	0	199	6	205	0	199	6	
Total Volume	0	35	728	0	755	2	0	66	68	0	683	11	674	0	683	11	674	0	683	11	674	0	683	11	
% App. Total	0.00	4.64	95.36	0.00	95.36	0.27	0.00	8.72	8.97	0.00	9.03	1.39	8.97	0.00	9.03	1.39	8.97	0.00	9.03	1.39	8.97	0.00	9.03	1.39	
HHF	.000	.719	.928	.000	.928	.000	.000	.000	.000	.810	.600	.615	.458	.000	.600	.615	.458	.000	.600	.615	.458	.000	.600	.615	

Wilson Okamoto Corporation

1907 S. Beretania Street Suite 400
Honolulu, HI 96826

Counter:D4-3890, D4-5677, D4-5675
Counted By:RY, ER, TO
Weather:Clear

File Name : KauNuh AM
Site Code : 00000002
Start Date : 9/16/2010
Page No : 1

		Groups Printed: Unshifted																			
		Second Entrance/Exit From KCC Southbound					Kauaui Highway Westbound					Nahu Street Northbound					Kauaui Highway Eastbound				
Start Time	End Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total
06:00 AM	06:15 AM	0	0	0	0	0	1	122	0	0	123	0	0	0	0	0	0	0	0	0	0
06:15 AM	06:30 AM	0	0	1	0	1	17	188	0	0	214	0	0	0	0	0	0	0	0	0	0
06:30 AM	06:45 AM	1	0	0	0	2	15	175	5	0	195	5	0	17	0	22	1	180	11	0	192
06:45 AM	07:00 AM	1	0	0	0	1	17	147	5	0	169	6	1	21	0	28	2	210	35	0	247
Total		2	1	2	0	5	50	632	20	0	709	20	1	38	0	50	3	681	56	0	740
07:00 AM	07:15 AM	1	0	0	0	1	25	165	14	0	204	9	3	35	0	47	1	210	24	0	235
07:15 AM	07:30 AM	11	2	0	0	14	42	175	32	0	249	15	8	77	0	100	1	180	29	0	210
07:30 AM	07:45 AM	18	30	1	0	49	49	181	50	0	280	16	13	63	0	92	1	162	42	2	207
07:45 AM	08:00 AM	30	19	0	0	49	42	173	47	0	262	21	12	23	0	56	3	191	32	1	226
Total		58	31	1	0	90	158	694	152	0	1004	61	36	198	0	206	5	743	137	3	885
08:00 AM	08:15 AM	17	7	0	0	24	23	179	16	0	218	16	2	18	0	36	3	216	28	0	247
08:15 AM	08:30 AM	4	1	0	0	5	12	171	12	0	185	10	1	12	0	23	1	215	16	0	232
08:30 AM	08:45 AM	4	3	1	0	8	14	146	19	0	179	13	2	10	0	25	2	223	8	0	233
08:45 AM	09:00 AM	8	2	0	0	10	7	154	21	0	182	12	8	11	0	33	3	184	22	0	209
Total		33	16	2	0	51	56	660	88	0	744	51	13	52	0	76	9	638	74	0	721
Grand Total		93	48	5	0	146	271	1976	240	0	2487	132	43	328	0	503	17	2262	270	3	2558
Approach %		63.7	32.9	3.4	0	2.6	10.9	79.5	9.7	0	43.7	26.2	8.5	65.2	0	8.8	0.7	69.8	10.5	0.1	44.9
Total %		1.6	0.8	0.1	0	2.6	4.8	34.7	4.2	0	43.7	2.3	0.8	5.8	0	8.8	0.3	39.8	4.7	0.1	44.9

		Groups Printed: Unshifted																			
		Second Entrance/Exit From KCC Southbound					Kauaui Highway Westbound					Nahu Street Northbound					Kauaui Highway Eastbound				
Start Time	End Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total
07:15 AM	07:30 AM	11	2	0	0	13	42	175	32	0	249	15	8	77	0	100	1	180	29	0	210
07:30 AM	07:45 AM	18	30	1	0	49	49	181	50	0	280	16	13	63	0	92	1	162	42	2	207
07:45 AM	08:00 AM	30	19	0	0	49	42	173	47	0	262	21	12	23	0	56	3	191	32	1	226
08:00 AM	08:15 AM	17	7	0	0	24	23	179	16	0	218	16	2	18	0	36	3	216	28	0	247
08:15 AM	08:30 AM	4	1	0	0	5	12	171	12	0	185	10	1	12	0	23	1	215	16	0	232
08:30 AM	08:45 AM	4	3	1	0	8	14	146	19	0	179	13	2	10	0	25	2	223	8	0	233
08:45 AM	09:00 AM	8	2	0	0	10	7	154	21	0	182	12	8	11	0	33	3	184	22	0	209
Total		74	38	1	0	113	158	708	154	0	1018	68	35	181	0	206	9	743	137	3	885
% App. Total		65.5	33.6	0.9	0	2.6	10.9	79.5	9.7	0	43.7	26.2	8.5	65.2	0	8.8	0.7	69.8	10.5	0.1	44.9
Peak		81	30	0	0	111	158	708	154	0	1018	68	35	181	0	206	9	743	137	3	885

Wilson Okamoto Corporation

1907 S. Beretania Street Suite 400
Honolulu, HI 96826

Counter:D4-5675
Counted By:TO
Weather:Clear

File Name : KauNani PM
Site Code : 00000001
Start Date : 9/14/2010
Page No : 1

		Groups Printed: Unshifted																			
		Second Entrance/Exit From KCC Southbound					Kauaui Highway Westbound					Nahu Street Northbound					Kauaui Highway Eastbound				
Start Time	End Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total
03:00 PM	03:15 PM	0	11	188	0	209	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
03:15 PM	03:30 PM	0	12	226	0	238	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
03:30 PM	03:45 PM	0	6	244	0	250	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
03:45 PM	04:00 PM	0	9	256	0	265	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total		0	38	625	0	663	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
04:00 PM	04:15 PM	0	7	244	0	251	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
04:15 PM	04:30 PM	0	7	247	0	254	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
04:30 PM	04:45 PM	0	11	242	0	253	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
04:45 PM	05:00 PM	0	4	231	0	235	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total		0	29	864	0	893	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
05:00 PM	05:15 PM	0	7	230	0	237	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
05:15 PM	05:30 PM	0	8	235	1	244	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
05:30 PM	05:45 PM	0	11	235	0	246	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total		0	26	800	1	827	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Grand Total		0	96	2805	1	2902	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Approach %		3.3	96.7	0	0	50.8	0.1	0	2.8	0	3	0	45.7	0.5	0	46.2					
Total %		0	1.7	49.1	0	50.8	0.1	0	2.8	0	3	0	45.7	0.5	0	46.2					

		Groups Printed: Unshifted																			
		Second Entrance/Exit From KCC Southbound					Kauaui Highway Westbound					Nahu Street Northbound					Kauaui Highway Eastbound				
Start Time	End Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total
03:45 PM	04:00 PM	0	11	244	0	255	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
04:00 PM	04:15 PM	0	7	244	0	251	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
04:15 PM	04:30 PM	0	7	247	0	254	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
04:30 PM	04:45 PM	0	11	242	0	253	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total		0	34	869	0	903	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% App. Total		3.3	96.7	0	0	50.8	0.1	0	2.8	0	3	0	45.7	0.5	0	46.2					
Peak		890	773	866	0	1669	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

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Wilson Okamoto Corporation
1907 S. Beretania Street Suite 400
Honolulu, HI 96826

		Groups Printed: Unshifted																			
		Second Entrance/Exit From KCC Southbound					Kauaui Highway Westbound					Nahu Street Northbound					Kauaui Highway Eastbound				
Start Time	End Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total
06:00 PM	06:15 PM	34	12	3	0	49	18	179	26	0	224	42	4	18	0	64	2	192	30	0	222
06:15 PM	06:30 PM	29	14	1	0	44	27	214	11	0	252	55	3	19	0	77	0	185	32	0	217
06:30 PM	06:45 PM	9	4	2	0	15	18	209	9	0	228	10	3	19	0	32	0	192	32	0	224
06:45 PM	07:00 PM	10	5	2	0	17	20	214	10	0	234	10	3	19	0	32	0	192	32	0	224
07:00 PM	07:15 PM	10	5	2	0	17	20	214	10	0	234	10	3	19	0	32	0	192	32	0	224
07:15 PM	07:30 PM	10	5	2	0	17	20	214	10	0	234	10	3	19	0	32	0	192	32	0	224
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07:45 PM	08:00 PM	10	5	2	0	17	20	214	10	0	234	10	3	19	0	32	0	192	32	0	224
08:00 PM	08:15 PM	10	5	2	0	17	20	214	10	0	234	10	3	19	0	32	0	192	32	0	224
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12:30 AM	12:45 AM	10	5	2	0	17	20	214	10	0	234	10	3	19	0	32	0	192	32	0	224
12:45 AM	1:00 AM	10	5	2	0																

Site Code:
Station ID:
KCC Driveway At Kaunuaʻali Highway
Latitude: 0° 0.000 Undefined

Site Code:
Station ID:
KCC Driveway At Kaumualii Highway
Latitude: 0' 0.000 Undefined

[illegible][illegible]

APPENDIX B

LEVEL OF SERVICE DEFINITIONS

LEVEL OF SERVICE DEFINITIONS

LEVEL-OF-SERVICE CRITERIA FOR SIGNALIZED INTERSECTIONS

Level of Service (LOS) for signalized intersections is defined in terms of delay, which is a measure of driver discomfort, frustration, fuel consumption, and increased travel time. Specifically, level-of-service (LOS) criteria are stated in terms of the average control delay per vehicle, typically a 15-min analysis period. The criteria are given in the following table.

Table 1: Level-of-Service Criteria for Signalized Intersections

Level of Service	Control Delay per Vehicle (sec/veh)
A	≤ 10.0
B	>10.0 and ≤ 20.0
C	>20.0 and ≤ 35.0
D	>35.0 and ≤ 55.0
E	>55.0 and ≤ 80.0
F	>80.0

Delay is a complex measure and depends on a number of variables, including the quality of progression, the cycle length, the green ratio, and the v/c ratio for the lane group.

Level of Service A describes operations with low control delay, up to 10 sec per vehicle. This level of service occurs when progression is extremely favorable and most vehicles arrive during the green phase. Many vehicles do not stop at all. Short cycle lengths may tend to contribute to low delay values.

Level of Service B describes operations with control delay greater than 10 and up to 20 sec per vehicle. This level generally occurs with good progression, short cycle lengths, or both. More vehicles stop than with LOS A, causing higher levels of delay.

Level of Service C describes operations with control delay greater than 20 and up to 35 sec per vehicle. These higher delays may result from only fair progression, longer cycle lengths, or both. Individual cycle failures may begin to appear at this level. Cycle failure occurs when a given green phase does not serve queued vehicles and overflows occur. The number of vehicles stopping is significant at this level, though many still pass through the intersection without stopping.

Level of Service D describes operations with control delay greater than 35 and up to 55 sec per vehicle. At level of service D, the influence of congestion becomes more noticeable. Longer delays may result from some combination of unfavorable progression, long cycle lengths, or high v/c ratios. Many vehicles stop, and the proportion of vehicles not stopping declines. Individual cycle failures are noticeable.

Level of Service F describes operations with control delay in excess of 80 sec per vehicle. This level, considered to be unacceptable to most drivers, often occurs with oversaturation, that is, when arrival flow rates exceed the capacity lane groups. It may also occur at high v/c ratios with many individual cycle failures. Poor progression and long cycle lengths may also contribute significantly to high delay levels.

Level of Service (LOS) criteria are given in Table 1. As used here, control delay is defined as the total elapsed time from the time a vehicle stops at the end of the queue to the time required for the vehicle to travel from the last-in-queue position to the first-in-queue position, including deceleration of vehicles from free-flow speed to the speed of vehicles in the queue.

The average total delay for any particular minor movement is a function of the service rate or capacity of the approach and the degree of saturation. If the degree of saturation is greater than about 0.9, average control delay is significantly affected by the length of the analysis period.

Table 1: Level-of-Service Criteria for Unsignalalized Intersections

Level of Service	Average Control Delay (Sec/Veh)
A	≤ 10.0
B	>10.0 and ≤ 15.0
C	>15.0 and ≤ 25.0
D	>25.0 and ≤ 35.0
E	>35.0 and ≤ 50.0
F	>50.0

"Highway Capacity Manual," Transportation Research Board, 2000.

¹"Highway Capacity Manual," Transportation Research Board, 2000.

APPENDIX C

CAPACITY ANALYSIS CALCULATIONS EXISTING PEAK HOUR TRAFFIC ANALYSIS

7/6/2012

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HCM Signalized Intersection Capacity Analysis 3: Puhi & Kaunualii

7/6/2012

Lane Configurations	7	4	4	4	4	4	4	4	4	4	4
Volume (vph)	49	788	159	34	919	59	131	39	54	85	29
Ideal Flow (vphpl)	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	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Fit 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 (vphpl)	1770	1863	1583	1770	1863	1583	1770	1863	1583	1770	1583
Fit 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 (vphpl)	1770	1863	1583	1770	1863	1583	1770	1863	1583	1770	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.97	0.97	0.97	0.91	0.91	0.91	0.61	0.61
Adj. Flow (vph)	51	821	166	35	947	51	210	40	59	138	30
RTOR Reduction (vph)	0	0	28	0	0	0	0	0	42	6	0
Lane Group Flow (vph)	51	821	138	35	947	52	220	12	6	172	30
Turn Type	Prot	NA	Perm	Prot	NA	Perm	NA	Perm	Perm	NA	Free
Permitted Phases	7	4	4	4	4	4	4	4	4	4	4
Actuated Green, G (s)	7.2	84.8	84.8	5.6	83.2	83.2	43.4	43.4	43.4	148.8	148.8
Effective Green, g (s)	7.2	84.8	84.8	5.6	83.2	83.2	43.4	43.4	43.4	148.8	148.8
Actuated g/C Ratio	0.05	0.57	0.57	0.04	0.56	0.56	0.23	0.23	0.23	0.53	0.53
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)	86	1062	902	67	1042	885	302	452	240	1583	1583
v/s Ratio Prot	0.03	0.44	0.09	0.02	0.51	0.03	0.24	0.01	0.21	0.06	0.06
v/s Ratio Perm	0.59	0.77	0.15	0.52	0.91	0.69	0.63	0.04	0.72	0.36	0.36
v/C Ratio	0.64	0.44	0.15	0.52	0.91	0.69	0.63	0.04	0.72	0.36	0.36
Uniform Delay, d1	69.4	34.8	15.1	70.3	29.4	15.0	49.2	37.7	47.2	0.0	0.0
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	10.5	3.6	0.1	7.2	11.3	0.0	16.8	0.0	9.9	0.1	0.1
Delay (s)	79.9	38.4	15.2	77.5	40.7	15.0	66.0	37.7	57.1	0.1	0.1
Level of Service	E	C	B	E	D	B	E	D	E	A	A
Approach Delay (s)	28.6			40.3			60.5		37.4		
Approach LOS	C			D			E		D		
HCM Average Control Delay	37.9										
HCM Volume to Capacity ratio	0.87										
Actuated Cycle Length (s)	148.8						15.0				
Intersection Capacity Utilization	75.8%						12.0				
Analysis Period (min)	15										
Control Lane Group											

PM Peak 10/19/2010 Baseline

Synchro 7 - Report
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HCM Unsignalized Intersection Capacity Analysis 9: Kaunualii & Nani

12/3/2010

Lane Configurations	7	4	4	4	4	4	4	4	4	4	4
Volume (veh/h)	803	5	39	727	1	94					
Sign Control	Free			Free	Stop						
Grade	0%			0%	0%						
Peak Hour Factor	0.91	0.91	0.94	0.94	0.85	0.85					
Hourly flow rate (vph)	882	5	41	773	1	111					
Pedestrians											
Lane Width (ft)											
Walking Speed (ft/s)											
Percent Blockage											
Right turn flare (veh)											
Median type	None			None							
Median storage (veh)											
Upstream signal (ft)	1175										
pK, platoon unblocked				0.60		0.60		0.60			
vC, conflicting volume				888		1742		885			
vC1, stage 1 conf vol											
vC2, stage 2 conf vol											
vC3, unblocked vol											
IC, 2 stage (s)				4.1		15.4		15.2			
IF (s)				2.2		3.5		3.3			
pD queue free %				94		98		73			
dM capacity (veh/h)				650		73		405			
Volume Total	808	5	39	727	1	94					
Volume Left	5	0	0	111							
Volume Right	1700	650	386								
cSH	0.52	0.98	0.29								
Volume to Capacity	0.52	0.98	0.29								
Queue Length 95th (ft)	0	5	30								
Control Delay (s)	6.9	1.8	18.1								
Lane LOS	A	C	C								
Approach Delay (s)	6.9	1.8	18.1								
Approach LOS	C										
Average Delay	1.9										
Intersection Capacity Utilization	82.6%										
Analysis Period (min)	15										
ICU Level of Service	E										
User Entered Value											

AM Peak 10/19/2010 Baseline

Synchro 7 - Report
Page 3

HCM Unsignalized Intersection Capacity Analysis 9: Kaunualii & Nani

12/3/2010

Lane Configurations	7	4	4	4	4	4	4	4	4	4	4
Volume (veh/h)	919	8	30	1010	2	49					
Sign Control	Free			Free	Stop						
Grade	0%			0%	0%						
Peak Hour Factor	0.95	0.95	0.99	0.99	0.78	0.78					
Hourly flow rate (vph)	967	8	30	1020	3	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)	1175										
pK, platoon unblocked				0.61		0.61		0.61			
vC, conflicting volume				976		2052		972			
vC1, stage 1 conf vol											
vC2, stage 2 conf vol											
vC3, unblocked vol											
IC, 2 stage (s)				4.1		15.4		15.2			
IF (s)				2.2		3.5		3.3			
pD queue free %				57.7		42		350			
dM capacity (veh/h)											
Volume Total	976	1021	65								
Volume Left	0	30	3								
Volume Right	8	0	63								
cSH	1700	577	272								
Volume to Capacity	0.57	0.05	0.24								
Queue Length 95th (ft)	0	4	23								
Control Delay (s)	6.0	1.8	22.4								
Lane LOS	A	C	C								
Approach Delay (s)	6.0	1.8	22.4								
Approach LOS	C										
Average Delay	1.6										
Intersection Capacity Utilization	87.3%										
Analysis Period (min)	15										
ICU Level of Service	E										
User Entered Value											

PM Peak 10/19/2010 Baseline

Synchro 7 - Report
Page 3

HCM Signalized Intersection Capacity Analysis 6: Nuhou & Kaunualii

7/6/2012

6: Nuhou & Kaumuali

The diagram shows a signalized intersection with four approaches: Northbound, Southbound, Eastbound, and Westbound. Each approach has a dedicated left-turn lane, a through-right lane, and a dedicated right-turn lane. The intersection is controlled by a four-phase traffic signal.

Lane Configurations	7	4	4	4	4	4	4	4	4	4	4
Volume (vph)	7	749	141	156	698	154	67	35	181	74	38
Ideal Flow (vphpl)	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	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Fit 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 (vphpl)	1770	1863	1583	1770	1863	1583	1770	1863	1583	1770	1583
Fit 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 (vphpl)	1770	1863	1583	1770	1863	1583	1770	1863	1583	1770	1583
Peak-hour factor, PHF	0.91	0.91	0.91	0.85	0.85	0.85	0.71	0.71	0.71	0.58	0.58
Adj. Flow (vph)	8	823	155	177	793	375	94	49	255	129	66
RTOR Reduction (vph)	0	0	26	0	4	0	0	0	199	0	0
Lane Group Flow (vph)	8	823	129	177	964	0	0	143	56	0	195
Turn Type	Prot	NA	Perm	Prot	NA	Perm	NA	Perm	NA	Perm	NA
Permitted Phases	7	4	4	4	4	4	4	4	4	4	4
Actuated Green, G (s)	1.8	72.9	72.9	19.5	90.6			30.2	30.2	30.2	90.2
Effective Green, g (s)	1.8	72.9	72.9	19.5	90.6			30.2	30.2	30.2	90.2
Actuated g/C Ratio	0.01	0.53	0.53	0.14	0.56			0.22	0.22	0.22	0.53
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)	23	987	839	251	1193			290	347	252	1193
v/s Ratio Prot	0.00	0.44	0.10	0.10	0.53			0.11	0.24	0.17	0.53
v/s Ratio Perm	0.35	0.83	0.15	0.71	0.81			0.46	0.16	0.38	0.38
v/C Ratio	0.73	0.22	0	0	0.73			0.72	0.22	0	0.73
Inc/Rel Delay, d1	0.35	27.2	16.6	10.9	17.2			45.5	47.0	30.5	50.5
Progression Delay, d2	0.00	1.00	1.00	1.00	1.00			1.00	1.00	1.00	1.00
Incremental Delay, d2	8.9	62.2	0.1	8.7	4.1			1.3	0.2	14.0	14.0
Delay (s)	76.3	33.4	16.8	50.5	21.3			46.3	43.2	64.5	64.5
Level of Service	E	C	B	E	C			D	D	E	E
Approach Delay (s)		31.1	C		28.6			45.3			45.3
Approach LOS		C			C			D			E
HCM Average Control Delay			34.3		HCM Level of Service			C			
HCM Volume to Capacity Ratio			0.81								
Actuated Cycle Length (s)			137.5		Sum of lost time (s)			15.0			
Intersection Capacity Utilization			24.7%		ICU Level of Service			D			
Analysis Period (min)			15								

Approach	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245	246	247	248	249	250	251	252	253	254	255	256	257	258	259	260	261	262	263	264	265	266	267	268	269	270	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294	295	296	297	298	299	300	301	302	303	304	305	306	307	308	309	310	311	312	313	314	315	316	317	318	319	320	321	322	323	324	325	326	327	328	329	330	331	332	333	334	335	336	337	338	339	340	341	342	343	344	345	346	347	348	349	350	351	352	353	354	355	356	357	358	359	360	361	362	363	364	365	366	367	368	369	370	371	372	373	374	375	376	377	378	379	380	381	382	383	384	385	386	387	388	389	390	391	392	393	394	395	396	397	398	399	400	401	402	403	404	405	406	407	408	409	410	411	412	413	414	415	416	417	418	419	420	421	422	423	424	425	426	427	428	429	430	431	432	433	434	435	436	437	438	439	440	441	442	443	444	445	446	447	448	449	450	451	452	453	454	455	456	457	458	459	460	461	462	463	464	465	466	467	468	469	470	471	472	473	474	475	476	477	478	479	480	481	482	483	484	485	486	487	488	489	490	491	492	493	494	495	496	497	498	499	500	501	502	503	504	505	506	507	508	509	510	511	512	513	514	515	516	517	518	519	520	521	522	523	524	525	526	527	528	529	530	531	532	533	534	535	536	537	538	539	540	541	542	543	544	545	546	547	548	549	550	551	552	553	554	555	556	557	558	559	560	561	562	563	564	565	566	567	568	569	570	571	572	573	574	575	576	577	578	579	580	581	582	583	584	585	586	587	588	589	590	591	592	593	594	595	596	597	598	599	600	601	602	603	604	605	606	607	608	609	610	611	612	613	614	615	616	617	618	619	620	621	622	623	624	625	626	627	628	629	630	631	632	633	634	635	636	637	638	639	640	641	642	643	644	645	646	647	648	649	650	651	652	653	654	655	656	657	658	659	660	661	662	663	664	665	666	667	668	669	670	671	672	673	674	675	676	677	678	679	680	681	682	683	684	685	686	687	688	689	690	691	692	693	694	695	696	697	698	699	700	701	702	703	704	705	706	707	708	709	710	711	712	713	714	715	716	717	718	719	720	721	722	723	724	725	726	727	728	729	730	731	732	733	734	735	736	737	738	739	740	741	742	743	744	745	746	747	748	749	750	751	752	753	754	755	756	757	758	759	760	761	762	763	764	765	766	767	768	769	770	771	772	773	774	775	776	777	778	779	780	781	782	783	784	785	786	787	788	789	790	791	792	793	794	795	796	797	798	799	800	801	802	803	804	805	806	807	808	809	810	811	812	813	814	815	816	817	818	819	820	821	822	823	824	825	826	827	828	829	830	831	832	833	834	835	836	837	838	839	840	841	842	843	844	845	846	847	848	849	850	851	852	853	854	855	856	857	858	859	860	861	862	863	864	865	866	867	868	869	870	871	872	873	874	875	876	877	878	879	880	881	882	883	884	885	886	887	888	889	890	891	892	893	894	895	896	897	898	899	900	901	902	903	904	905	906	907	908	909	910	911	912	913	914	915	916	917	918	919	920	921	922	923	924	925	926	927	928	929	930	931	932	933	934	935	936	937	938	939	940	941	942	943	944	945	946	947	948	949	950	951	952	953	954	955	956	957	958	959	960	961	962	963	964	965	966	967	968	969	970	971	972	973	974	975	976	977	978	979	980	981	982	983	984	985	986	987	988	989	990	991	992	993	994	995	996	997	998	999	1000	1001	1002	1003	1004	1005	1006	1007	1008	1009	1010	1011	1012	1013	1014	1015	1016	1017	1018	1019	1020	1021	1022	1023	1024	1025	1026	1027	1028	1029	1030	1031	1032	1033	1034	1035	1036	1037	1038	1039	1040	1041	1042	1043	1044	1045	1046	1047	1048	1049	1050	1051	1052	1053	1054	1055	1056	1057	1058	1059	1060	1061	1062	1063	1064	1065	1066	1067	1068	1069	1070	1071	1072	1073	1074	1075	1076	1077	1078	1079	1080	1081	1082	1083	1084	1085	1086	1087	1088	1089	1090	1091	1092	1093	1094	1095	1096	1097	1098	1099	1100	1101	1102	1103	1104	1105	1106	1107	1108	1109	1110	1111	1112	1113	1114	1115	1116	1117	1118	1119	1120	1121	1122	1123	1124	1125	1126	1127	1128	1129	1130	1131	1132	1133	1134	1135	1136	1137	1138	1139	1140	1141	1142	1143	1144	1145	1146	1147	1148	1149	1150	1151	1152	1153	1154	1155	1156	1157	1158	1159	1160	1161	1162	1163	1164	1165	1166	1167	1168	1169	1170	1171	1172	1173	1174	1175	1176	1177	1178	1179	1180	1181	1182	1183	1184	1185	1186	1187	1188	1189	1190	1191	1192	1193	1194	1195	1196	1197	1198	1199	1200	1201	1202	1203	1204	1205	1206	1207	1208	1209	1210	1211	1212	1213	1214	1215	1216	1217	1218	1219	1220	1221	1222	1223	1224	1225	1226	1227	1228	1229	1230	1231	1232	1233	1234	1235	1236	1237	1238	1239	1240	1241	1242	1243	1244	1245	1246	1247	1248	1249	1250	1251	1252	1253	1254	1255	1256	1257	1258	1259	1260	1261	1262	1263	1264	1265	1266	1267	1268	1269	1270	1271	1272	1273	1274	1275	1276	1277	1278	1279	1280	1281	1282	1283	1284	1285	1286	1287	1288	1289	1290	1291	1292	1293	1294	1295	1296	1297	1298	1299	1300	1301	1302	1303	1304	1305	1306	1307	1308	1309	1310	1311	1312	1313	1314	1315	1316	1317	1318	1319	1320	1321	1322	1323	1324	1325	1326	1327	1328	1329	1330	1331	1332	1333	1334	1335	1336	1337	1338	1339	1340	1341	1342	1343	1344	1345	1346	1347	1348	1349	1350	1351	1352	1353	1354	1355	1356	1357	1358	1359	1360	1361	1362	1363	1364	1365	1366	1367	1368	1369	1370	1371	1372	1373	1374	1375	1376	1377	1378	1379	1380	1381	1382	1383	1384	1385	1386	1387	1388	1389	1390	1391	1392	1393	1394	1395	1396	1397	1398	1399	1400	1401	1402	1403	1404	1405	1406	1407	1408	1409	1410	1411	1412	1413	1414	1415	1416	1417	1418	1419	1420	1421	1422	1423	1424	1425	1426	1427	1428	1429	1430	1431	1432	1433	1434	1435	1436	1437	1438	1439	1440	1441	1442	1443	1444	1445	1446	1447	1448	1449	1450	1451	1452	1453	1454	1455	1456	1457	1458	1459	1460	1461	1462	1463	1464	1465	1466	1467	1468	1469	1470	1471	1472	1473	1474	1475	1476	1477	1478	1479	148
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APPENDIX E
CAPACITY ANALYSIS CALCULATIONS
PROJECTED YEAR 2020 PEAK HOUR TRAFFIC
ANALYSIS WITHOUT PROJECT

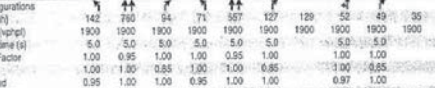
TABLE 6
FULL-TIME EQUIVALENT COURSE ENROLLMENT SERVED BY CAMPUS
UNIVERSITY OF HAWAII
FALL 2009 TO FALL 2015

	ACTUAL						PROJECTED				
	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
UH SYSTEM TOTAL	36,888	40,640	41,947	43,047	43,882	44,385	44,570				
UH AT MANOA	16,336	16,485	16,655	16,822	16,914	17,007	17,072				
UH AT HILLO	3,453	3,665	3,773	3,850	3,926	3,988	4,045				
UH - WEST OAHU	730	615	604	1,059	1,193	1,305	1,400				
UH COMMUNITY COLLEGES	16,479	18,662	20,612	21,336	21,820	22,085	22,153				
Hawaii Community College	2,071	2,324	2,478	2,505	2,689	2,728	2,737				
Honolulu Community College	2,571	2,685	2,785	2,883	2,969	3,045	3,057				
Regional Community College	5,035	5,282	5,461	5,605	5,720	5,768	5,790				
Kaula Community College	778	864	920	959	979	986	995				
Leeward Community College	4,339	4,334	4,481	4,607	4,664	4,680	4,699				
Maui Community College	2,419	2,705	2,909	3,029	3,116	3,165	3,202				
Windward Community College	1,286	1,465	1,578	1,648	1,684	1,711	1,716				

HCM Signalized Intersection Capacity Analysis

3: Puhi & Kaunualii

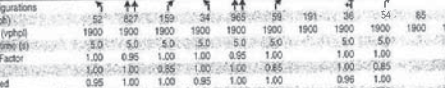
7/6/2012

												
Lane Configurations	2	2	2	2	2	2	2	2	2	2	2	
Volume (vph)	142	190	94	71	567	127	128	52	49	35	30	
Ideal Flow (vphpl)	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	0.95	1.00	1.00	0.95	1.00	1.00	1.00	1.00	1.00	1.00	
Fit Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.97	1.00	0.97	1.00	0.95	
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583	1770	3539	1583	1770	3539	
Fit Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.97	1.00	0.97	1.00	0.95	
Satd. Flow (perm)	1770	3539	1583	1770	3539	1583	1770	3539	1583	1770	3539	
Peak-hour factor, PHF	0.94	0.94	0.94	0.93	0.93	0.93	0.92	0.92	0.92	0.57	0.57	
Adj. Flow (vph)	151	189	190	76	599	137	140	57	53	61	53	
RTOR Reduction (vph)	0	0	48	0	0	90	0	0	40	0	0	
Lane Group Flow (vph)	151	189	190	76	599	147	0	107	13	0	154	
Turn Type	Prot	NA	Perm	Prot	NA	Perm	NA	Perm	Perm	NA	Perm	
Permitted Phases	7	4	4	3	8	2	2	6	2	6	6	
Actuated Green, G (s)	11.9	27.0	27.0	7.1	22.2	22.2	16.2	16.2	16.2	16.2	16.2	
Effective Green, g (s)	11.9	27.0	27.0	7.1	22.2	22.2	16.2	16.2	16.2	16.2	16.2	
Actuated g/C Ratio	0.18	0.41	0.41	0.11	0.34	0.34	0.23	0.23	0.23	0.23	0.23	
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)	323	1463	855	192	1203	538	332	383	349	393	320	
v/s Ratio Prot	0.009	0.223	0.04	0.17	0.03	0.03	0.015	0.01	0.08	0.02	0.02	
v/s Ratio Perm	0.47	0.55	0.58	0.48	0.50	0.09	0.59	0.63	0.33	0.36	0.36	
Uniform Delay, d1	23.9	14.6	11.6	27.1	17.1	14.7	21.6	18.5	20.1	18.7	19.7	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	1.1	0.5	0.1	1.3	0.3	0.1	2.8	0.0	0.5	0.1	0.1	
Delay (s)	24.9	15.0	11.7	28.4	17.4	14.7	24.4	18.5	20.6	18.8	19.8	
Level of Service	C	B	B	C	B	B	C	B	B	C	B	
Approach Delay (s)	16.1	15.0	11.7	28.4	17.4	14.7	24.4	18.5	20.6	18.8	19.8	
Approach LOS	B	B	B	C	B	B	C	B	B	C	B	
HCM Average Control Delay	17.9						19.8					
HCM Volume to Capacity ratio	0.59						0.65					
Actuated Cycle Length (s)	65.3						75.8					
Intersection Capacity Utilization	54.0%						59.5%					
Analysis Period (min)	15						15					
Critical Lane Group	C						C					

HCM Signalized Intersection Capacity Analysis

3: Puhi & Kaunualii

7/6/2012

												
Lane Configurations	2	2	2	2	2	2	2	2	2	2	2	
Volume (vph)	52	837	1529	34	963	59	191	36	54	85	20	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)	3.0	5.0	5.0	3.0	5.0	5.0	3.0	5.0	5.0	3.0	5.0	
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00	1.00	1.00	
Fit Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.97	1.00	0.97	1.00	0.95	
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583	1768	3539	1768	3539	1583	
Fit Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.97	1.00	0.97	1.00	0.95	
Satd. Flow (perm)	1770	3539	1583	1770	3539	1583	1900	1195	1583	1770	3539	
Peak-hour factor, PHF	0.96	0.96	0.96	0.97	0.97	0.97	0.91	0.91	0.91	0.91	0.91	
Adj. Flow (vph)	54	861	166	35	995	61	210	40	59	139	33	
RTOR Reduction (vph)	0	0	75	0	0	24	0	0	6	40	0	
Lane Group Flow (vph)	54	861	166	35	995	37	210	40	59	139	33	
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Perm	NA	Perm	Perm	NA	
Permitted Phases	7	4	4	3	8	2	2	6	2	6	6	
Actuated Green, G (s)	42	33.3	33.3	2.9	32.5	32.0	24.8	24.8	24.8	24.8	24.8	
Effective Green, g (s)	42	33.3	33.3	2.9	32.0	32.0	24.8	24.8	24.8	24.8	24.8	
Actuated g/C Ratio	0.06	0.44	0.44	0.04	0.34	0.34	0.33	0.33	0.33	0.33	0.33	
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)	98	1555	698	68	1494	668	385	514	385	514	385	
v/s Ratio Prot	0.030	0.224	0.06	0.02	0.028	0.028	0.021	0.021	0.021	0.021	0.021	
v/s Ratio Perm	0.55	0.55	0.55	0.55	0.55	0.06	0.65	0.64	0.54	0.05	0.05	
Uniform Delay, d1	34.9	15.7	12.0	35.8	17.5	13.0	21.9	17.5	20.9	17.6	17.6	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	6.6	0.4	0.1	6.4	1.1	0.9	3.8	0.0	1.7	0.1	0.1	
Delay (s)	41.4	16.2	12.1	42.2	18.7	13.9	25.7	17.5	22.7	17.7	17.7	
Level of Service	D	B	B	C	B	B	C	B	C	B	B	
Approach Delay (s)	16.9	15.0	11.7	42.2	17.9	13.0	24.1	17.5	21.9	17.6	17.6	
Approach LOS	B	B	B	C	B	B	C	B	C	B	B	
HCM Average Control Delay	19.8						19.8					
HCM Volume to Capacity ratio	0.65						0.65					
Actuated Cycle Length (s)	75.8						Sum of lost time (s)					
Intersection Capacity Utilization	61.9%						15.0					
Analysis Period (min)	15						C					
Critical Lane Group	C						C					

HCM Unsignalized Intersection Capacity Analysis 9: Kaumualii & Nani

12/3/2010

	→	↖	↗	←	→	↖	↗
Lane Configurations	↑↑	↑	↑↑	↑↑	↑	↑↑	↑
Volume (veh/h)	839	5	39	754	1	94	
Sign Control	Free			Free	Stop		
Grade	0%			0%	0%		
Peak Hour Factor	0.91	0.91	0.94	0.94	0.85	0.85	
Hourly flow rate (vph)	922	5	41	802	1	111	
Pedestrians							
Lane Width (ft)							
Walking Speed (ft/s)							
Percent Blockage							
Right turn flare (veh)							
Median type	None			None			
Median storage (veh)							
Upstream signal (ft)	1175						
pX, platoon unblocked				0.90		0.90	
vC, conflicting volume				927		1409	
vC1, stage 1 conf vol							
vC2, stage 2 conf vol							
vCu, unblocked vol				690		1226	
IC, single (s)				4.1		6.8	
IC, 2 stage (s)							
IF (s)				2.2		3.5	
p0 queue free %				95		92	
CM capacity (veh/h)				808		145	
Volume Total	615	313	41	401	421	112	
Volume Left	0	0	41	0	0	1	
Volume Right	0	5	0	0	0	111	
cSH	1700	1700	808	1700	1700	722	
Volume to Capacity	0.36	0.18	0.05	0.24	0.24	0.15	
Queue Length 95th (%)	0	0	4	0	0	14	
Control Delay (s)	0.0	0.0	9.7	0.0	0.0	10.9	
Lane LOS			A			B	
Approach Delay (s)	0.0		0.5			10.9	
Approach LOS			B			B	
Average Delay			0.9				
Intersection Capacity Utilization			42.8%				
Analysis Period (min)			15				
ICU Level of Service						A	

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HCM Unsignalized Intersection Capacity Analysis 9: Kaumualii & Nani

12/3/2010

	→	↖	↗	←	→	↖	↗
Lane Configurations	↑↑	↑	↑↑	↑↑	↑	↑↑	↑
Volume (veh/h)	958	8	30	1056	2	49	
Sign Control	Free			Free	Stop		
Grade	0%			0%	0%		
Peak Hour Factor	0.95	0.95	0.99	0.99	0.78	0.78	
Hourly flow rate (vph)	1008	8	30	1067	3	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)	1175						
pX, platoon unblocked				0.88		0.88	
vC, conflicting volume				1017		1607	
vC1, stage 1 conf vol							
vC2, stage 2 conf vol							
vCu, unblocked vol				743		1414	
IC, single (s)				4.1		6.8	
IC, 2 stage (s)							
IF (s)				2.2		3.5	
p0 queue free %				96		92	
CM capacity (veh/h)				756		108	
Volume Total	672	345	30	533	533	65	
Volume Left	0	0	30	0	0	3	
Volume Right	0	8	0	0	0	63	
cSH	1700	1700	756	1700	1700	608	
Volume to Capacity	0.40	0.20	0.04	0.31	0.31	0.11	
Queue Length 95th (%)	0	0	3	0	0	9	
Control Delay (s)	0.0	0.0	16.0	0.0	0.0	11.5	
Lane LOS			A			B	
Approach Delay (s)	0.0		0.3			11.5	
Approach LOS			B			B	
Average Delay			0.5				
Intersection Capacity Utilization			39.2%				
Analysis Period (min)			15				
ICU Level of Service						A	

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HCM Signalized Intersection Capacity Analysis 6: Nuhoou & Kaumualii

7/6/2012

	→	↖	↗	←	→	↖	↗
Lane Configurations	↑↑	↑	↑↑	↑↑	↑	↑↑	↑
Volume (vph)	1900	1900	1900	1900	1900	1900	1900
Ideal Flow (vphpl)	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
Lane Util. Factor	1.00	0.99	1.00	1.00	0.95	1.00	1.00
Fit Protected	0.95	1.00	1.00	0.95	1.00	0.97	1.00
Satd. Flow (prot)	1770	3539	1583	1770	3432	1810	1583
Fit Permitted	0.95	1.00	1.00	0.95	1.00	0.72	1.00
Satd. Flow (perm)	1770	3539	1583	1770	3432	1335	1583
Peak-hour factor, PHF	0.91	0.91	0.91	0.95	0.95	0.85	0.71
Adj. Flow (vph)	883	1555	177	324	299	94	160
RTOR Reduction (vph)	0	0	66	0	18	0	0
Lane Group Flow (vph)	883	89	177	1017	0	160	67
Turn Type	Prot	NA	Perm	Prot	NA	Perm	NA
Protected Phases	7	4	3	3	2	2	6
Actuated Green, G (s)	1.9	34.0	34.0	14.5	47.5	22.8	22.8
Effective Green, g (s)	1.9	34.0	34.0	14.5	47.5	22.8	22.8
Actuated g/C Ratio	0.01	0.39	0.39	0.17	0.55	0.28	0.28
Clearance Time (s)	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
Lane Grp Cap (vph)	21	1394	624	297	1889	353	418
v/s Ratio Prot	0.00	0.24	0.10	0.30			
v/s Ratio Perm		0.06			0.12	0.04	0.19
v/c Ratio	0.38	0.62	0.34	0.50	0.24	0.45	0.16
Uniform Delay, d1	42.3	21.0	18.8	33.2	12.4	25.5	24.4
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	11.2	0.8	0.1	3.2	0.3	0.9	0.2
Delay (s)	53.5	21.8	19.0	36.4	12.7	26.5	24.6
Level of Service	D	C	B	D	B	C	D
Approach Delay (s)	21.8		0.5		15.8		21.7
Approach LOS	C		B		C		C
HCM Average Control Delay			21.1				
HCM Volume to Capacity ratio			0.63				
Actuated Cycle Length (s)			86.3			15.0	
Intersection Capacity Utilization			57.2%				
Analysis Period (min)			15				
ICU Level of Service						B	

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HCM Signalized Intersection Capacity Analysis 6: Nuhoou & Kaumualii

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	→	↖	↗	←	→	↖	↗
Lane Configurations	↑↑	↑	↑↑	↑↑	↑	↑↑	↑
Volume (vph)	309	113	46	590	69	183	29
Ideal Flow (vphpl)	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
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Fit Protected	0.95	1.00	1.00	0.95	1.00	0.96	1.00
Satd. Flow (prot)	1770	3539	1583	1770	3501	1758	1583
Fit Permitted	0.95	1.00	1.00	0.95	1.00	0.69	1.00
Satd. Flow (perm)	1770	3539	1583	1770	3501	1276	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.96	0.96	0.91	0.91
Adj. Flow (vph)	925	125	50	927	72	201	32
RTOR Reduction (vph)	0	0	51	0	5	0	0
Lane Group Flow (vph)	925	74	50	994	0	233	24
Turn Type	Prot	NA	Perm	Prot	NA	Perm	NA
Protected Phases	7	4	3	3	2	2	6
Actuated Green, G (s)	0.8	31.7	31.7	4.4	35.3	21.0	21.0
Effective Green, g (s)	0.8	31.7	31.7	4.4	35.3	21.0	21.0
Actuated g/C Ratio	0.01	0.44	0.44	0.06	0.46	0.29	0.29
Clearance Time (s)	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
Lane Grp Cap (vph)	20	1556	696	108	1714	372	461
v/s Ratio Prot	0.01	0.28	0.03	0.28			
v/s Ratio Perm		0.05			0.18	0.02	0.13
v/c Ratio	0.45	0.59	0.11	0.45	0.58	0.53	0.44
Uniform Delay, d1	35.4	15.3	11.9	32.7	13.1	22.1	18.4
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	15.3	0.6	0.1	3.1	0.5	3.3	0.9
Delay (s)	50.7	15.9	11.9	35.8	13.6	25.4	18.4
Level of Service	D	B	B	D	B	C	B
Approach Delay (s)	15.8		1.7		23.6		21.7
Approach LOS	B		B		C		C
HCM Average Control Delay			16.6				
HCM Volume to Capacity ratio			0.62				
Actuated Cycle Length (s)			72.1			15.0	
Intersection Capacity Utilization			57.6%				
Analysis Period (min)			15				
ICU Level of Service						B	

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APPENDIX F
CAPACITY ANALYSIS CALCULATIONS
PROJECTED YEAR 2020 PEAK HOUR TRAFFIC
ANALYSIS WITH PROJECT

HCM Signalized Intersection Capacity Analysis
3: Puhi & Kaunuaiali

7/6/2012

Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Volume (vph)	153	760	94	71	557	140	129	57	49	37	32	87
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	5.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00	1.00	1.00	1.00	0.85
Fit Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.97	1.00	0.97	1.00	0.97	1.00
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583	1600	1583	1614	1583	1614	1583
Fit Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.72	1.00	0.75	1.00	0.75	1.00
Satd. Flow (perm)	1770	3539	1583	1770	3539	1583	1159	1583	1195	1583	1195	1583
Peak-hour factor, PHF	0.94	0.94	0.94	0.95	0.95	0.95	0.92	0.92	0.92	0.92	0.92	0.95
Adj. Flow (vph)	163	809	100	76	599	140	129	57	49	37	32	87
RTOR Reduction (vph)	0	0	48	0	0	100	0	0	40	0	0	75
Lane Group Flow (vph)	163	809	51	76	599	51	0	202	13	0	121	25
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Perm	NA	Perm	Perm	NA	Perm
Permitted Phases	1	4	5	3	8	2	2	2	6	6	6	6
Actuated Green, G (s)	12.4	27.2	27.2	7.1	21.9	21.9	16.7	16.7	16.7	16.7	16.7	16.7
Effective Green, g (s)	12.4	27.2	27.2	7.1	21.9	21.9	16.7	16.7	16.7	16.7	16.7	16.7
Actuated g/C Ratio	0.19	0.41	0.41	0.31	0.35	0.35	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	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	3.0
Lane Grp Cap (vph)	333	1458	652	190	1174	525	339	401	353	401	353	401
v/s Ratio Prot	0.09	0.23	0.04	0.17	0.09	0.09	0.15	0.01	0.09	0.02	0.09	0.02
v/s Ratio Perm	0.49	0.55	0.08	0.28	0.51	0.50	0.60	0.23	0.54	0.23	0.54	0.23
v/s Ratio	0.49	0.55	0.08	0.28	0.51	0.50	0.60	0.23	0.54	0.23	0.54	0.23
Uniform Delay, d1	24.0	14.3	11.9	27.5	17.7	15.2	21.7	18.6	20.2	18.7	20.2	18.7
Progression Factor, f	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	1.1	0.5	0.1	1.4	0.4	0.1	2.8	0.0	0.0	0.0	0.0	0.1
Delay (s)	25.1	14.8	12.0	28.9	18.1	15.3	24.5	18.6	20.2	18.7	20.2	18.7
Level of Service	C	B	B	C	B	B	C	B	C	B	C	B
Approach Delay (s)	16.4	16.4	16.4	16.4	16.4	16.4	16.4	16.4	16.4	16.4	16.4	16.4
Approach LOS	B	B	B	B	B	B	C	B	C	B	C	B
HCM Average Control Delay	18.2											
HCM Level of Service	B											
HCM Volume to Capacity ratio	0.59											
Actuated Cycle Length (s)	66.0											
Sum of lost time (s)	15.0											
Intersection Capacity Utilization	54.2%											
ICU Level of Service	A											
Analysis Period (min)	15											
Control Data Group	C											

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HCM Signalized Intersection Capacity Analysis
3: Puhi & Kaunuaiali

7/6/2012

Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Volume (vph)	59	827	159	34	565	68	191	42	54	92	22	64
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	5.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00	1.00	1.00	1.00	0.85
Fit Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.96	1.00	0.96	1.00	0.96	1.00
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583	1788	1583	1790	1583	1790	1583
Fit Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.61	1.00	0.51	1.00	0.51	1.00
Satd. Flow (perm)	1770	3539	1583	1770	3539	1583	1140	1583	857	1583	857	1583
Peak-hour factor, PHF	0.96	0.96	0.96	0.97	0.97	0.97	0.91	0.91	0.91	0.91	0.91	0.91
Adj. Flow (vph)	61	861	166	35	595	70	210	45	59	151	35	105
RTOR Reduction (vph)	0	0	72	0	0	27	0	0	40	0	0	71
Lane Group Flow (vph)	61	861	34	35	595	33	0	255	19	0	157	34
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Perm	NA	Perm	Perm	NA	Perm
Permitted Phases	1	4	5	3	8	2	2	2	6	6	6	6
Actuated Green, G (s)	5.7	35.8	35.8	3.0	33.1	33.1	25.3	25.3	25.3	25.3	25.3	25.3
Effective Green, g (s)	5.7	35.8	35.8	3.0	33.1	33.1	25.3	25.3	25.3	25.3	25.3	25.3
Actuated g/C Ratio	0.07	0.45	0.45	0.04	0.42	0.42	0.32	0.32	0.32	0.32	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	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	3.0
Lane Grp Cap (vph)	128	1602	716	67	1481	662	365	506	306	506	306	506
v/s Ratio Prot	0.03	0.24	0.05	0.02	0.26	0.03	0.22	0.01	0.20	0.02	0.20	0.02
v/s Ratio Perm	0.40	0.54	0.13	0.52	0.57	0.06	0.70	0.04	0.61	0.07	0.61	0.07
v/s Ratio	0.40	0.54	0.13	0.52	0.57	0.06	0.70	0.04	0.61	0.07	0.61	0.07
Uniform Delay, d1	35.3	15.7	12.6	37.3	18.5	13.7	23.6	18.5	22.7	18.7	22.7	18.7
Progression Factor, f	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	2.8	0.3	0.1	7.2	1.2	0.0	6.0	0.0	3.6	0.1	3.6	0.1
Delay (s)	38.1	16.0	12.7	44.5	19.7	13.7	29.6	18.5	26.3	18.7	26.3	18.7
Level of Service	D	B	B	D	B	B	C	B	C	B	C	B
Approach Delay (s)	15.7	15.7	15.7	15.7	15.7	15.7	15.7	15.7	15.7	15.7	15.7	15.7
Approach LOS	B	B	B	B	B	B	C	B	C	B	C	B
HCM Average Control Delay	20.0											
HCM Level of Service	C											
HCM Volume to Capacity ratio	0.72											
Actuated Cycle Length (s)	78.1											
Sum of lost time (s)	20.0											
Intersection Capacity Utilization	62.0%											
ICU Level of Service	B											
Analysis Period (min)	15											
Control Data Group	C											

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HCM Unsignalized Intersection Capacity Analysis
9: Kaunuaiali & Nani

12/3/2010

Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔		
Volume (veh/h)	841	5	39	767	1	94	5	39	767	1	94	5		
Sign Control	Free			Free	Stop	Stop	Free			Free	Stop	Stop		
Grade	0%			0%	0%	0%	0%			0%	0%	0%		
Peak Hour Factor	0.91	0.91	0.94	0.94	0.85	0.85	0.91	0.91	0.94	0.94	0.85	0.85		
Hourly flow rate (vph)	924	5	41	816	1	111	924	5	41	816	1	111		
Pedestrians														
Lane Width (ft)														
Walking Speed (ft/s)														
Percent Blockage														
Right turn lane (veh)														
Median type	None			None			None							
Median storage (veh)														
Upstream signal (ft)	1175													
pX, platoon unblocked			0.89		0.89	0.89								
vC, conflicting volume			930		1418	405								
vC1, stage 1 conf vol														
vC2, stage 2 conf vol														
vC, unblocked vol			886		1231	166								
IC, single (s)			4.1		6.8	6.9								
IC, 2 stage (s)														
IC (s)			2.2		3.5	3.3								
p0 queue free %			95		99	85								
cM capacity (veh/h)			809		144	760								
Volume Total	616	314	41	408	408	112	616	314	41	408	408	112		
Volume Left	0	0	41	0	0	0	0	0	41	0	0	0		
Volume Right	0	5	0	0	0	0	0	5	0	0	0	0		
cSH	1700	1700	809	1700	1700	727	1700	1700	809	1700	1700	727		
Volume to Capacity	0.36	0.18	0.05	0.24	0.24	0.15	0.36	0.18	0.05	0.24	0.24	0.15		
Queue Length 95th (ft)	0	0	4	0	0	14	0	0	4	0	0	14		
Control Delay (s)	0.0	0.0	9.7	0.0	0.0	10.8	0.0	0.0	9.7	0.0	0.0	10.8		
Lane LOS			A			B			A			B		
Approach Delay (s)	0.0		9.5			10.8	0.0		9.5			10.8		
Approach LOS			B			B			B			B		
Average Delay				9.3							9.3			
Intersection Capacity Utilization				42.6%				ICU Level of Service			A			
Analysis Period (min)				15										

HCM Unsignalized Intersection Capacity Analysis 9: Kaunualii & Nani

12/3/2010

Lane Configurations	3	1	1	1	3	1	1	1	1
Volume (veh/h)	965	8	30	1005	2	49			
Sign Control	Free			Free	Stop				
Grade	0%			0%	0%				
Peak Hour Factor	0.95	0.95	0.99	0.99	0.78	0.78			
Hourly flow rate (vph)	1016	8	30	1076	3	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)	1175								
pX, platoon unblocked									
VC, conflicting volume									
VC1, stage 1 cont vol									
VC2, stage 2 cont vol									
VCu, unblocked vol									
IC, single (s)									
IC, 2 stage (s)									
IF (s)									
p0 queue free %									
cM capacity (veh/h)									
Volume Total	877	347	30	538	538	85			
Volume Left	0	0	30	0	0	3			
Volume Right	0	0	0	0	0	163			
cM	1700	1700	750	1700	1700	600			
Volume to Capacity	0.40	0.20	0.04	0.32	0.32	0.11			
Outsue Length 95th (ft)									
Control Delay (s)	0.0	0.0	10.0	0.0	0.0	11.7			
Lane LOS									
Approach Delay (s)	0.0		0.3			11.7			
Approach LOS									
Average Delay			0.5						
Intersection Capacity Utilization			39.4%						
Analysis Period (min)			15						
ICU Level of Service: A									

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HCM Signalized Intersection Capacity Analysis 6: Nuhou & Kaunualii

7/6/2012

Lane Configurations	3	1	1	1	3	1	1	1	1
Volume (vph)	7	767	141	156	728	184	167	47	181
Ideal Flow (vphpl)	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	0.95	1.00	1.00	0.95	1.00	1.00	1.00	1.00
Flt	1.00	1.00	0.85	1.00	0.97	1.00	0.95	1.00	0.95
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.97	1.00	0.97
Satd. Flow (prot)	1770	3539	1583	1770	3430	1770	1610	1553	1604
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.72	1.00	0.65
Satd. Flow (perm)	1770	3539	1583	1770	3430	1770	1335	1553	1263
Peak-hour factor, PHF	0.91	0.91	0.91	0.88	0.88	0.88	0.71	0.71	0.58
Adj. Flow (vph)	8	665	155	177	630	209	66	255	150
RTOR Reduction (vph)	0	0	66	0	15	0	0	188	0
Lane Group Flow (vph)	8	665	221	177	1003	224	166	443	150
Turn Type	Prot	NA	Perm	Prot	NA	Perm	NA	Perm	NA
Permitted Phases	3	4	3	4	3	4	2	6	3
Actuated Green, G (s)	1.0	34.0	34.0	14.5	47.5	22.8	22.8	22.8	22.8
Effective Green, g (s)	1.0	34.0	34.0	14.5	47.5	22.8	22.8	22.8	22.8
Actuated g/C Ratio	0.013	0.39	0.39	0.17	0.29	0.29	0.29	0.29	0.29
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)	21	1394	624	297	1890	353	418	334	334
v/c Ratio Prot	0.00	0.02	0.04	0.03	0.03	0.12	0.04	0.19	0.19
v/c Ratio Perm	0.38	0.62	0.14	0.60	0.55	0.45	0.16	0.73	0.73
Uniform Delay, d1	42.3	21.0	16.8	33.2	12.5	26.5	24.4	28.9	28.9
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	11.2	0.9	0.1	3.2	0.3	6.9	0.2	7.7	7.7
Delay (s)	53.5	21.9	16.9	36.4	12.8	33.4	24.6	36.6	36.6
Level of Service	D	C	B	D	B	C	C	D	D
Approach Delay (s)	21.3		16.2		26.7		36.6		36.6
Approach LOS	C		B		C		D		D
HCM Average Control Delay: 21.1 HCM Level of Service: C									
HCM Volume to Capacity ratio: 0.65									
Actuated Cycle Length (s): 80.3 Sum of lost time (s): 15.0									
Intersection Capacity Utilization: 47.2% ICU Level of Service: B									
Analysis Period (min): 15									
Critical Lane Group									

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HCM Signalized Intersection Capacity Analysis 6: Nuhou & Kaunualii

7/6/2012

Lane Configurations	3	1	1	1	3	1	1	1	1
Volume (vph)	9	836	119	48	899	69	183	29	78
Ideal Flow (vphpl)	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	0.95	1.00	1.00	0.95	1.00	1.00	1.00	1.00
Flt	1.00	1.00	0.85	1.00	0.99	1.00	0.85	0.99	0.99
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.96	1.00	0.97
Satd. Flow (prot)	1770	3539	1583	1770	3501	1770	1786	1583	1777
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.68	1.00	0.61
Satd. Flow (perm)	1770	3539	1583	1770	3501	1770	1279	1583	1121
Peak-hour factor, PHF	0.95	0.95	0.95	0.99	0.96	0.96	0.91	0.91	0.84
Adj. Flow (vph)	9	833	125	50	936	72	201	32	84
RTOR Reduction (vph)	0	0	50	0	5	0	0	60	0
Lane Group Flow (vph)	9	833	75	50	1003	8	233	24	140
Turn Type	Prot	NA	Perm	Prot	NA	Perm	NA	Perm	NA
Permitted Phases	3	4	3	4	3	4	2	6	3
Actuated Green, G (s)	0.8	32.0	32.0	4.4	35.8	21.1	21.1	21.1	21.1
Effective Green, g (s)	0.8	32.0	32.0	4.4	35.8	21.1	21.1	21.1	21.1
Actuated g/C Ratio	0.01	0.44	0.44	0.05	0.48	0.29	0.29	0.29	0.29
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)	20	1562	699	107	1719	371	461	326	326
v/c Ratio Prot	0.01	0.26	0.05	0.03	0.29	0.18	0.02	0.13	0.13
v/c Ratio Perm	0.45	0.60	0.11	0.42	0.58	0.63	0.05	0.44	0.44
Uniform Delay, d1	35.5	15.4	11.9	32.9	13.2	22.3	18.5	20.9	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	15.3	0.6	0.1	3.2	0.5	3.3	0.6	0.9	0.9
Delay (s)	50.8	16.0	11.8	36.1	13.7	25.6	19.1	21.8	21.8
Level of Service	D	C	B	D	B	C	B	C	C
Approach Delay (s)	15.8		14.7		23.7		21.8		21.8
Approach LOS	B		B		C		C		C
HCM Average Control Delay: 16.7 HCM Level of Service: B									
HCM Volume to Capacity ratio: 0.82									
Actuated Cycle Length (s): 72.5 Sum of lost time (s): 15.0									
Intersection Capacity Utilization: 37.8% ICU Level of Service: B									
Analysis Period (min): 15									
Critical Lane Group									

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