

# Appendix D

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Traffic Impact Report for the  
Island School Master Plan  
Prepared by  
Wilson Okamoto Corporation  
December 2010

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**TRAFFIC IMPACT REPORT**  
**FOR THE**  
**ISLAND SCHOOL MASTER PLAN**

*Prepared for:*

Island School  
3-1875 Kaunualii Highway  
Lihue, Hawaii 96766

*Prepared by:*

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December 2010

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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 Island School’s master plan. Island School is a private Pre-K to 12<sup>th</sup> grade school located adjacent the Kauai Community College on the island of Kauai.

**B. Scope of Study**

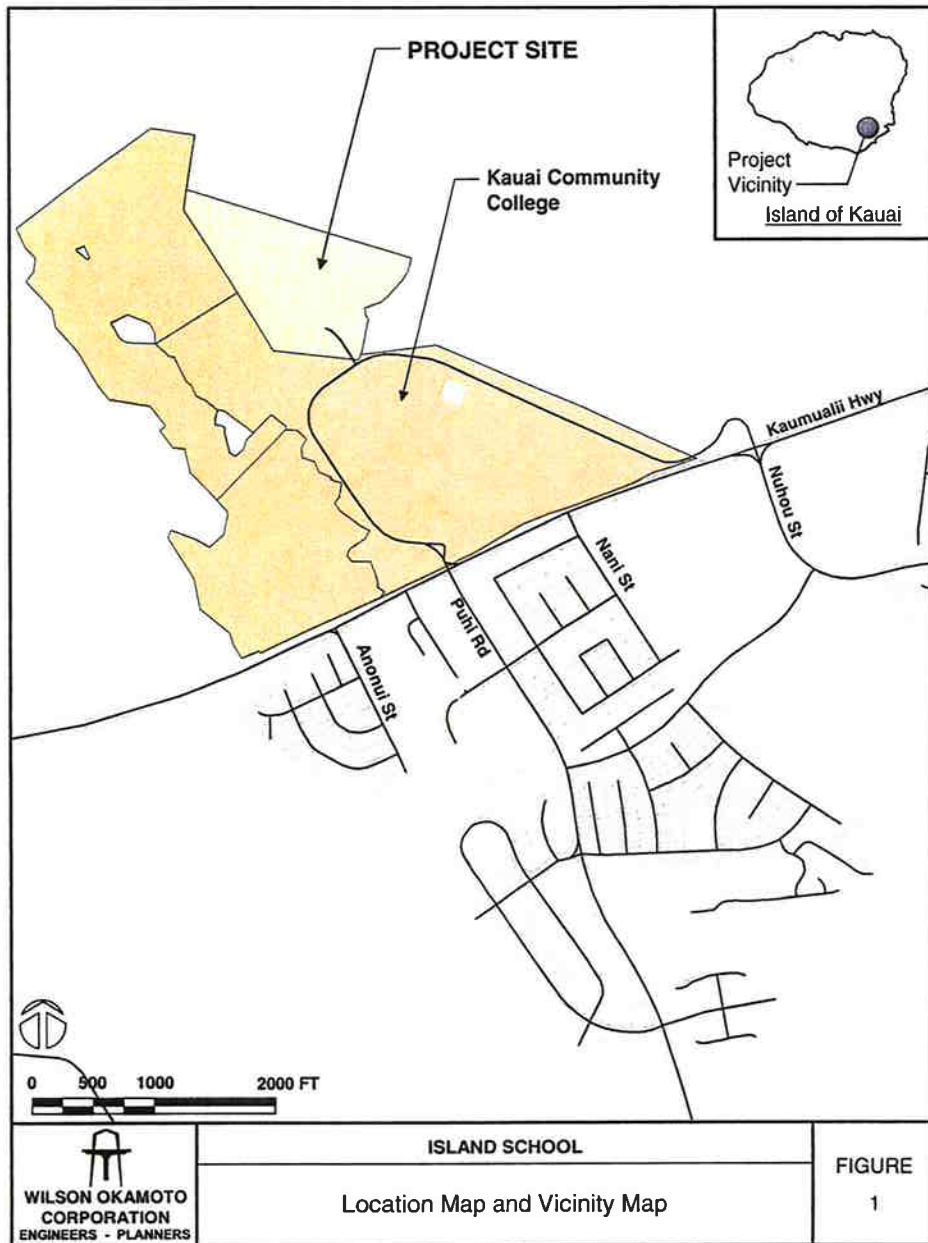
This report presents the findings and conclusions of the traffic study, the scope of which includes:

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**

Island School is located adjacent to Kauai Community College (KCC) north of Kaumualii Highway in Puhi on the island of Kauai, and is further identified as Tax Map Key: 3-8-02: 16 (see Figure 1). The project site is bounded by agricultural uses to the north and east, Gaylord’s Restaurant to the south, and KCC to the west. Access to Island School is provided via access roads shared with Kauai Community College at the intersections of Kaumualii Highway with Puhi Road and Nuhou Street.



**B. Project Characteristics**

The master plan for Island School entails the expansion the private school's campus over the next 10 years to provide additional classrooms and facilities. The site plan for the proposed expansion is shown in Figure 2 and includes the construction of the following:

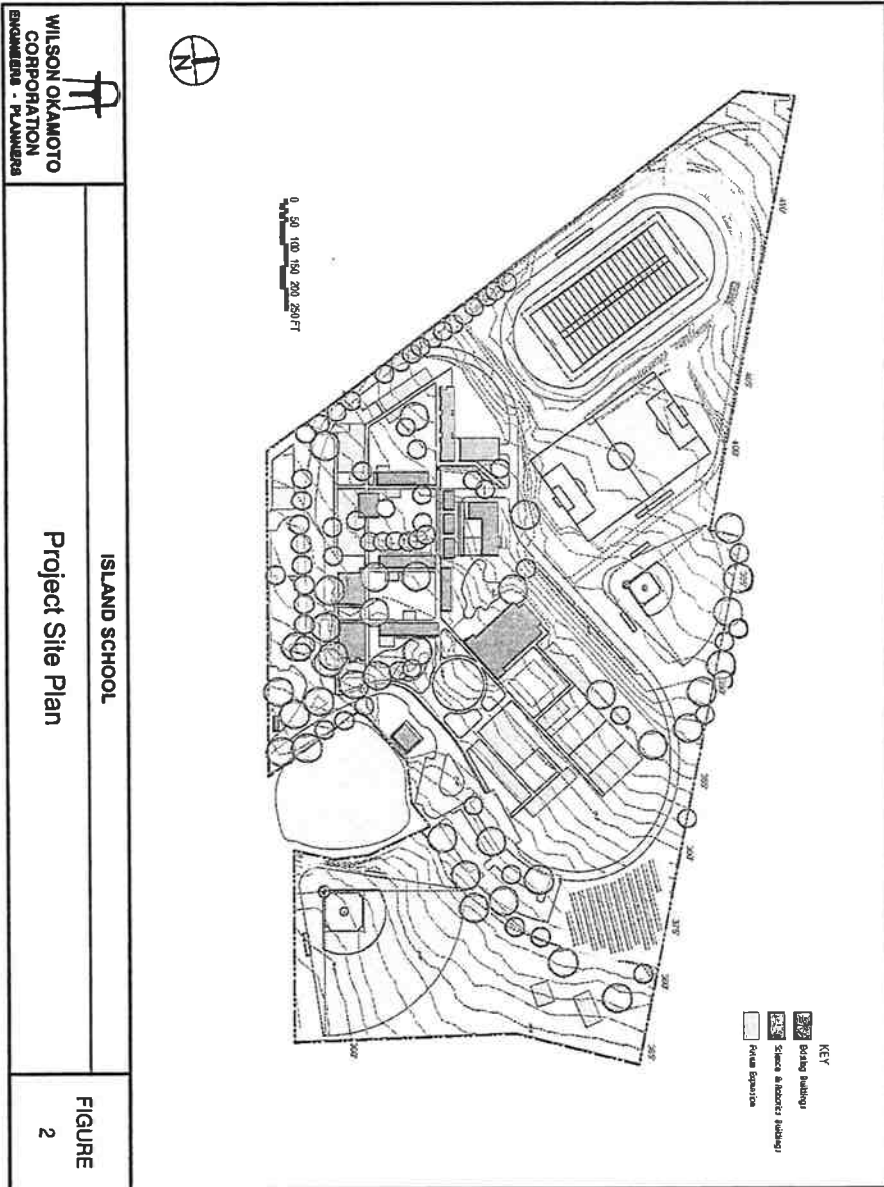
- Classroom buildings
- Science building
- Dining hall
- Campus Center with a library, computer rooms, and a bookstore
- Auditorium and stage
- Locker rooms
- Arts Education building
- Sports fields
- Additional Visual Arts facilities
- Additional administrative facilities
- Additional parking areas

In conjunction with the proposed expansion, enrollment at the school is expected to increase until the expected completion of the project in the Year 2020. Island School currently serves 20 Pre-K students and 340 students from grades K to 12. By the Year 2020, Pre-K enrollment is not expected to increase, but enrollment for students from grades K to 12 is expected to increase to 480.

**III. EXISTING TRAFFIC CONDITIONS**

**A. Area Roadway System**

In the vicinity of Island School, Kaumualii Highway is a predominantly two-lane, two-way roadway generally oriented in the east-west direction. At the signalized intersection with Puhi Road, both approaches of Kaumualii Highway have exclusive turning lanes and one through lane. Puhi 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 Puhi 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 western access road for KCC and Island School 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 eastern access for KCC and Island School 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.

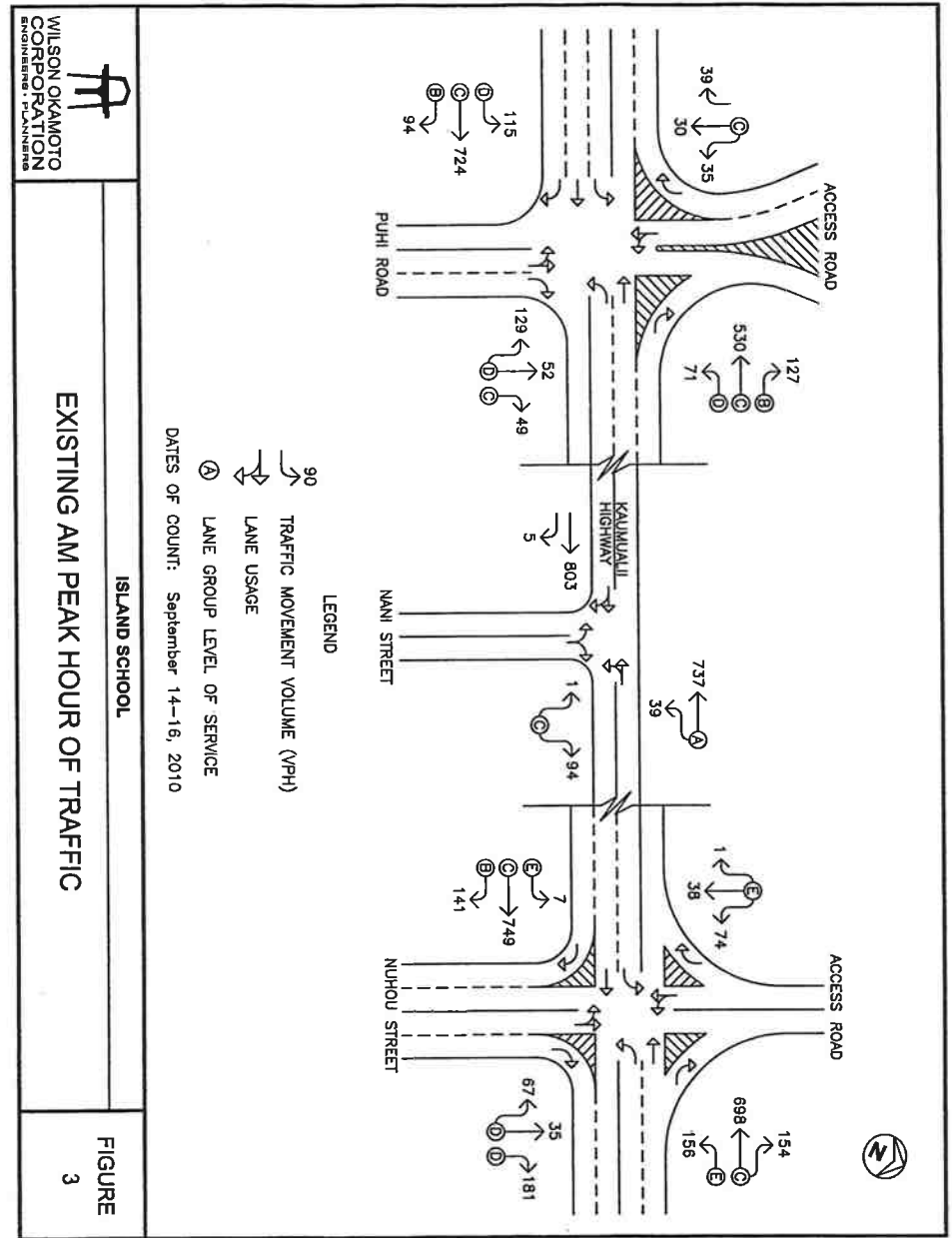
LOS is a quantitative and qualitative assessment of traffic operations. Levels of Service are defined by LOS "A" through "F"; LOS "A" representing ideal or free-flow traffic operating conditions and LOS "F" unacceptable or potentially congested traffic operating conditions.

"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

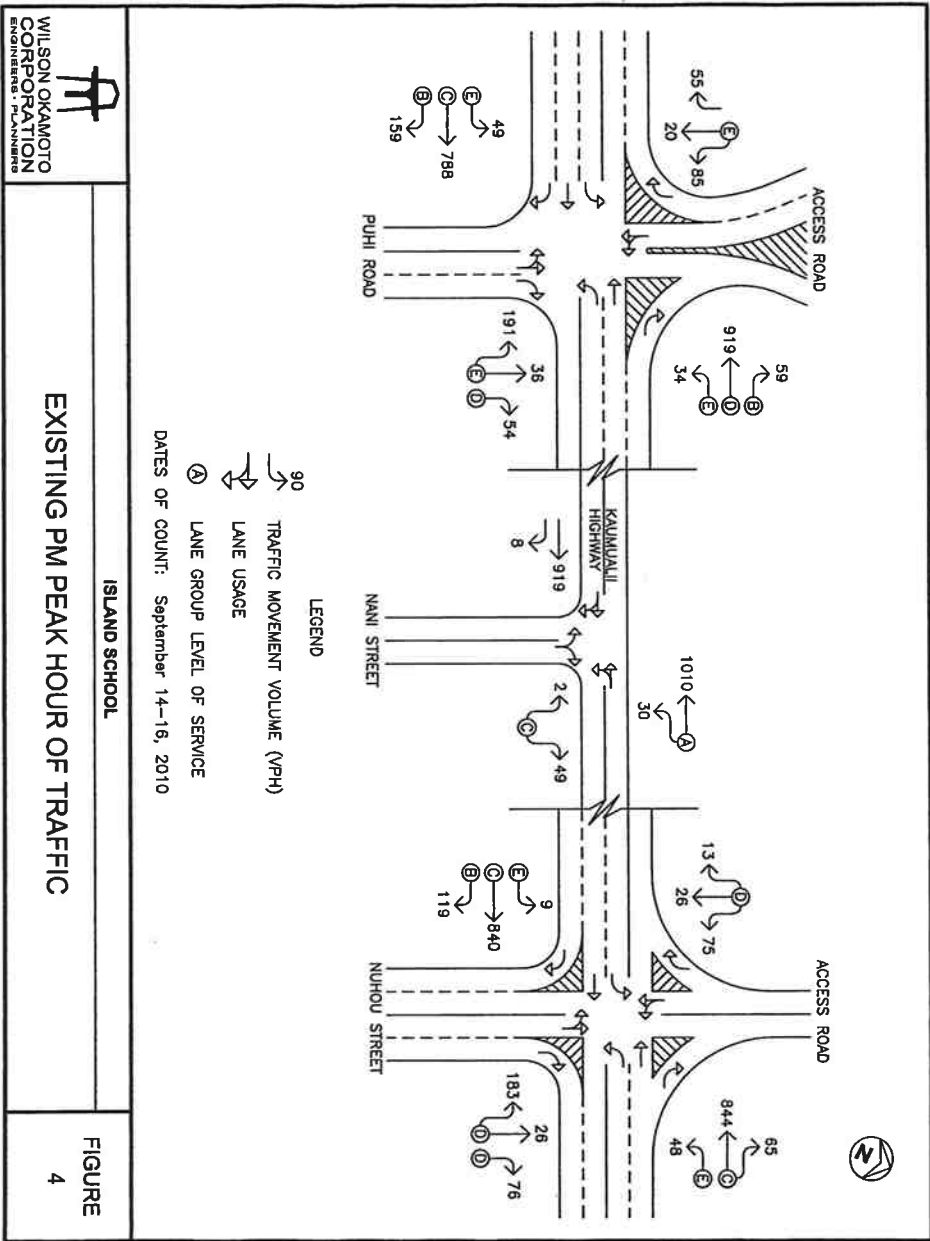


peak hour time periods to identify the traffic impacts resulting from the proposed project. LOS calculations are included in Appendix C.

**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 western access road for KCC and Island School 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 eastern access road for KCC and Island School 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

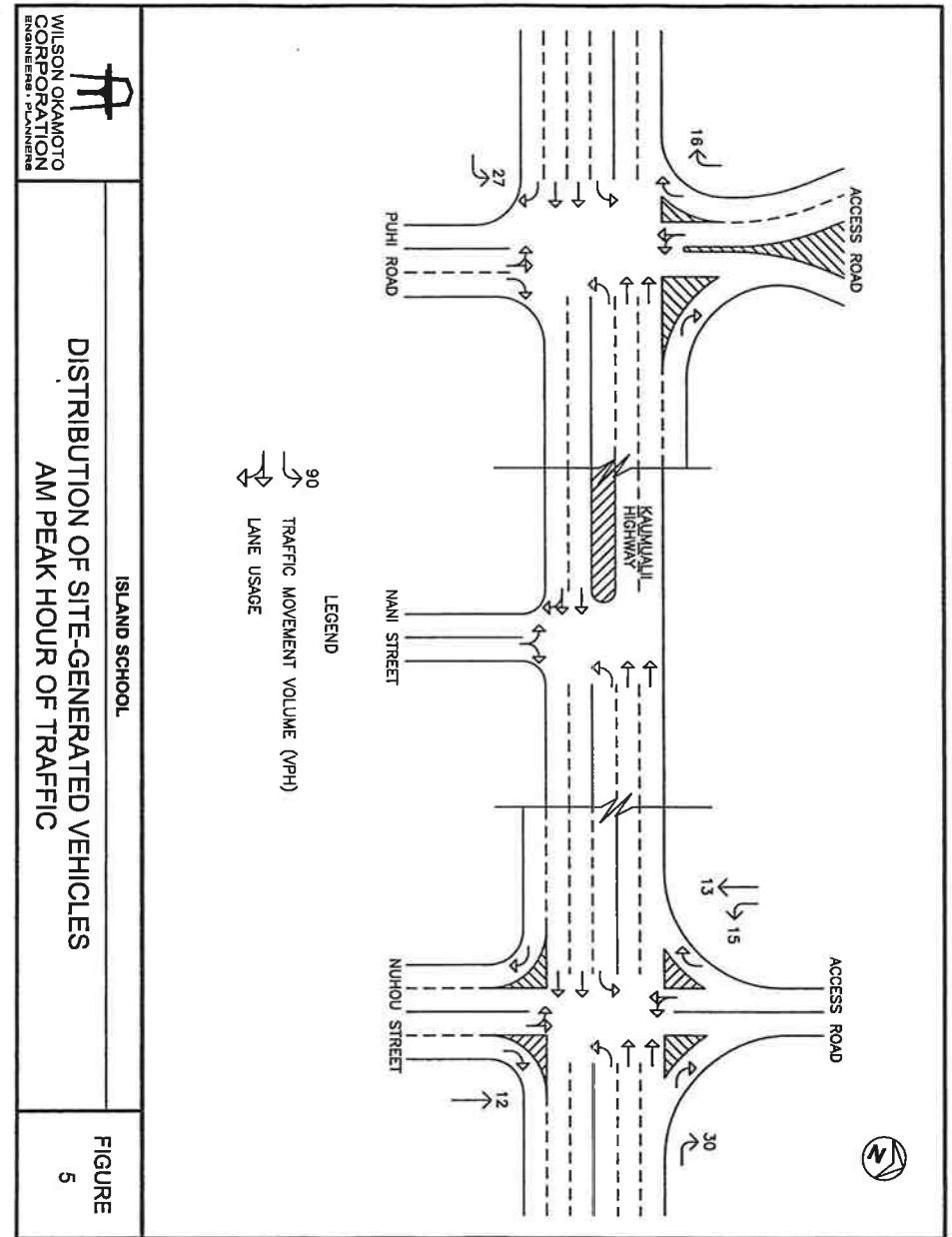
The trip generation methodology used in this study is based upon generally accepted techniques developed by the Institute of Transportation Engineers (ITE) and published in "Trip Generation, 8<sup>th</sup> Edition," 2008. The ITE trip generation rates are developed empirically by correlating the vehicle trip generation data with various land use characteristics such as the number of vehicle trips generated per student. 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

PRIVATE SCHOOL (K-12)		
INDEPENDENT VARIABLE:		PROJECTED TRIP ENDS
Increase in enrollment = 140 students		
AM PEAK	ENTER	69
	EXIT	44
	TOTAL	113
PM PEAK	ENTER	10
	EXIT	14
	TOTAL	24

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. Vehicular access to Island School is provided via two access roadways off Kaumualii Highway. The directional distribution of new site-generated vehicles was based upon the existing distribution of traffic at the more heavily utilized intersection with Puhi Street. As such, 39.1% of entering vehicles were assumed to be headed from areas to the west during the AM peak period, 43.2% were assumed to be headed from areas to the east, and 17.7% were assumed to be headed from areas south to the south. Similarly, 37.5% of exiting vehicles were assumed to be headed to area to the west, 33.7% were



WILSON OKAMOTO CORPORATION ENGINEERS & PLANNERS

ISLAND SCHOOL  
DISTRIBUTION OF SITE-GENERATED VEHICLES  
AM PEAK HOUR OF TRAFFIC

FIGURE 5

assumed to be headed to areas to the east, and 28.8% were assumed to be headed to areas to the south. During the PM peak period, 34.0% of entering vehicles were assumed to be headed from areas from the west, 41.0% were assumed to be headed from areas to the east, and 25.0% were assumed to be headed from areas to the south. Similarly, 34.4% of exiting vehicles were assumed to be headed to areas in the west, 53.1% were assumed to be headed to areas in the east, and 12.5% were assumed to be headed to areas to the south. Based upon the relative convenience of the available routes and the anticipated volume of conflicting traffic, all vehicles headed to and from the west were assumed to utilize the western access at the intersection of Kaumualii Highway with Puhi Street while all vehicles headed to and from the east and south were assumed to utilize the eastern access at the intersection of Kaumualii Highway with Nuhou Street.

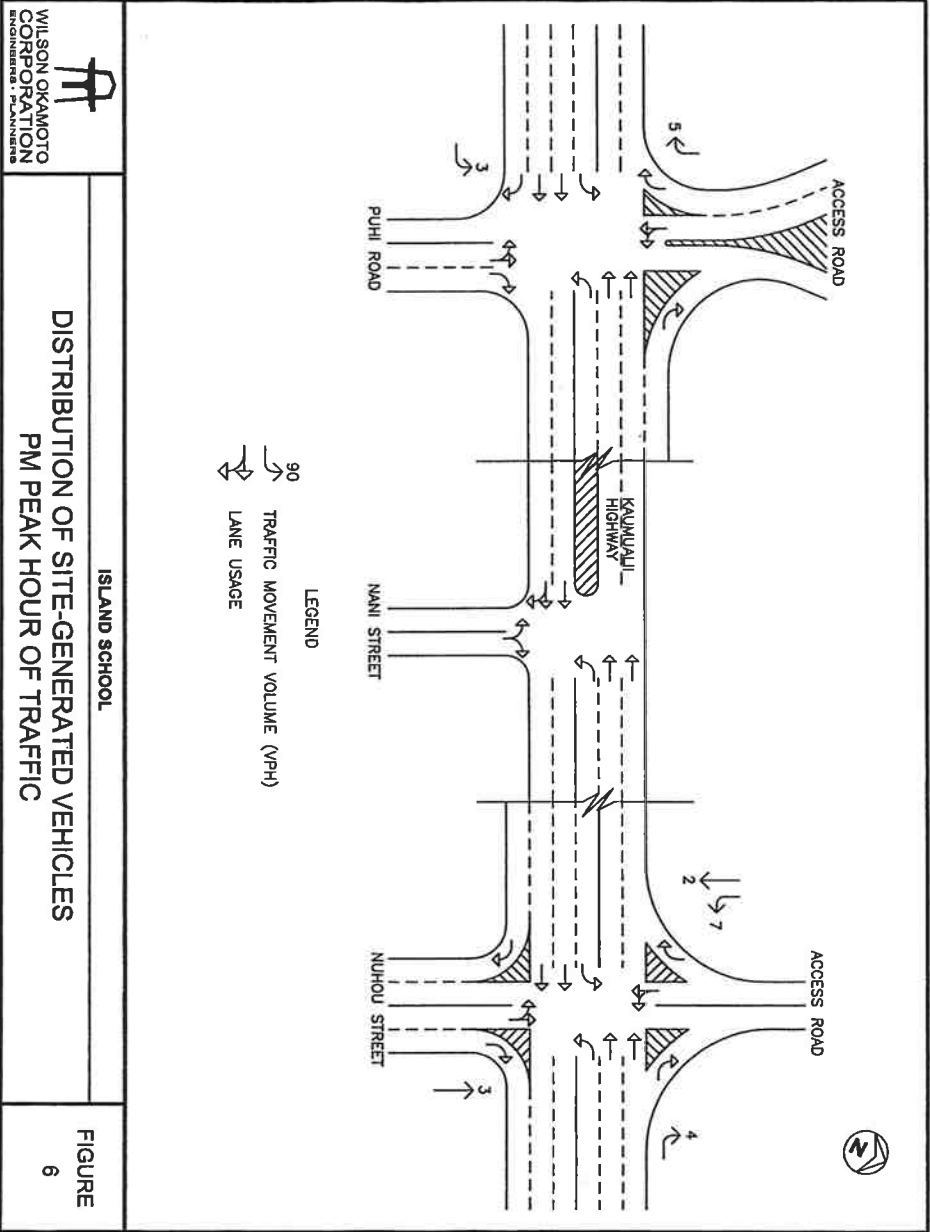
**B. Through Traffic Forecasting Methodology**

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. Kauai Community College**

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. In conjunction with the planned expansion, enrollment at the school is expected to increase from the current enrollment of 864 students to an enrollment of 1,038 students by the Year 2020. As described in the “Traffic Impact Report for the Kauai Community College Long Range



Development Plan" dated December 2010, the increase in enrollment at the college is expected to result in approximately 35 new trips during the AM peak period and 35 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 college's LRDP.

**2. Kaunualii Highway Widening**

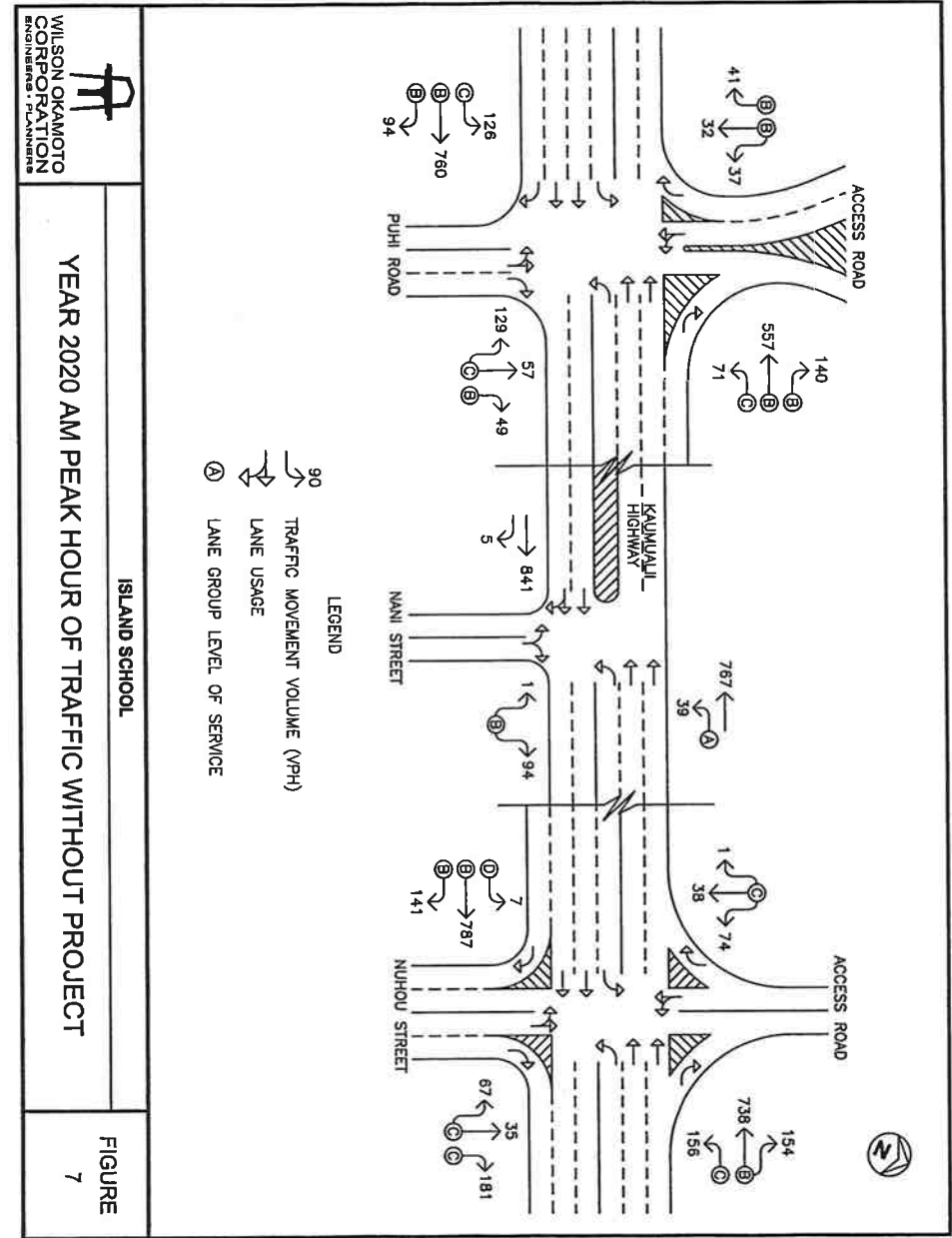
The State of Hawaii Department of Transportation is currently widening Kaunualii Highway from a two-lane undivided highway to a four-lane divided highway between Anonui Road and the Lihue Mill Bridge. The highway will have two travel lanes in each direction with auxiliary lanes provided at the intersections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

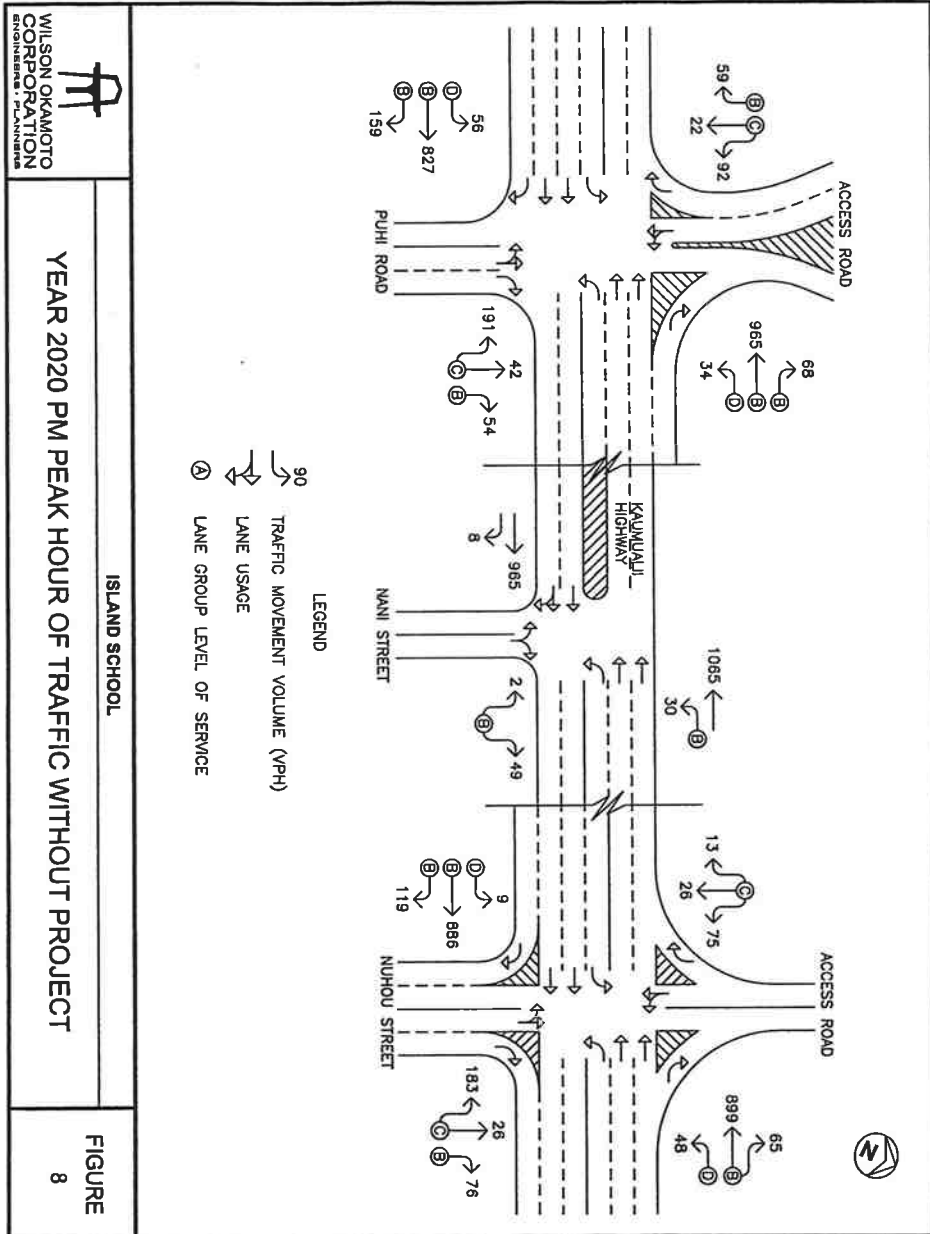
**D. Total Traffic Volumes Without Project**

The projected Year 2020 AM and PM peak hour traffic volumes and operating conditions without the implementation Island School's master plan are shown on Figures 7 and 8, and summarized in Table 2. Kaunualii 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 D.

**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	
Kaunualii Hwy/ Puhi Rd	Eastbound	LT	D	C	E	D
		TH	C	B	C	B
		RT	B	B	B	B
	Westbound	LT	D	C	E	D
		TH	C	B	D	B
		RT	B	B	B	B





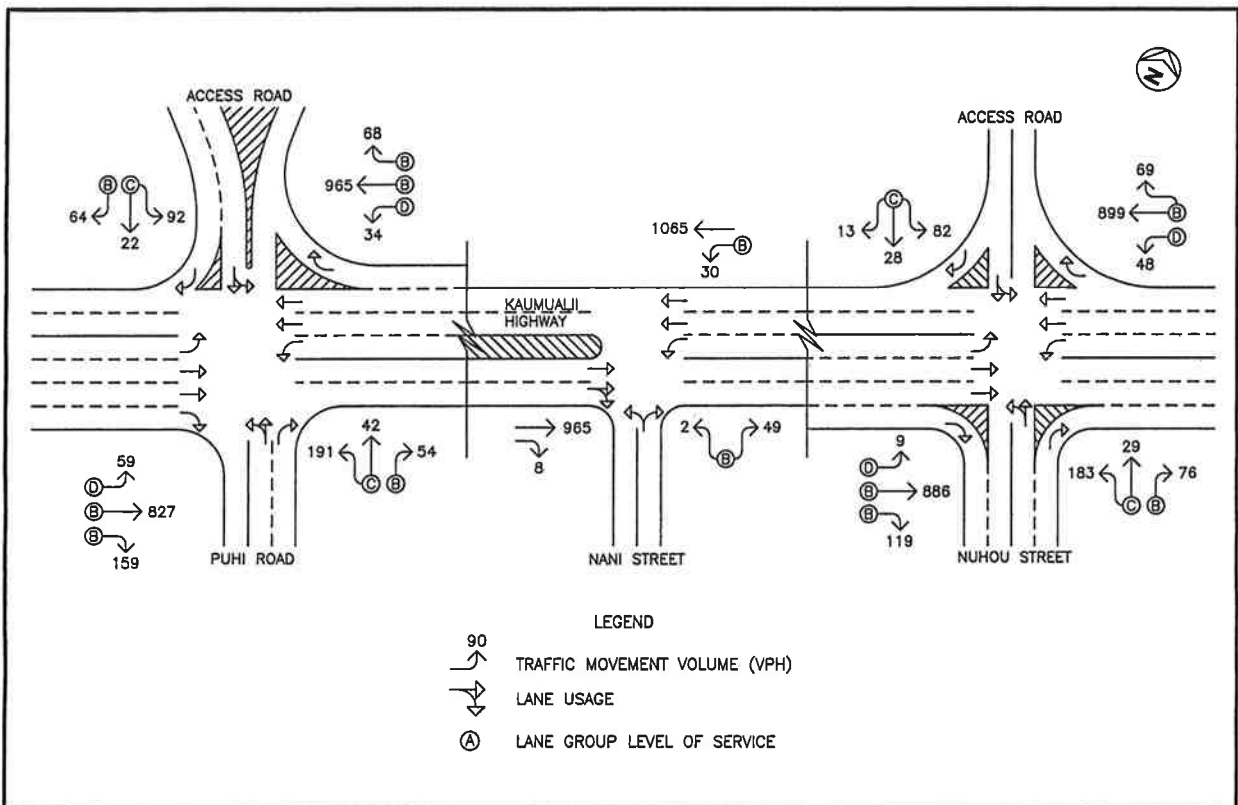
**Table 2: Existing and Projected Year 2020 (Without Project) Traffic Operating Conditions (Cont'd)**


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

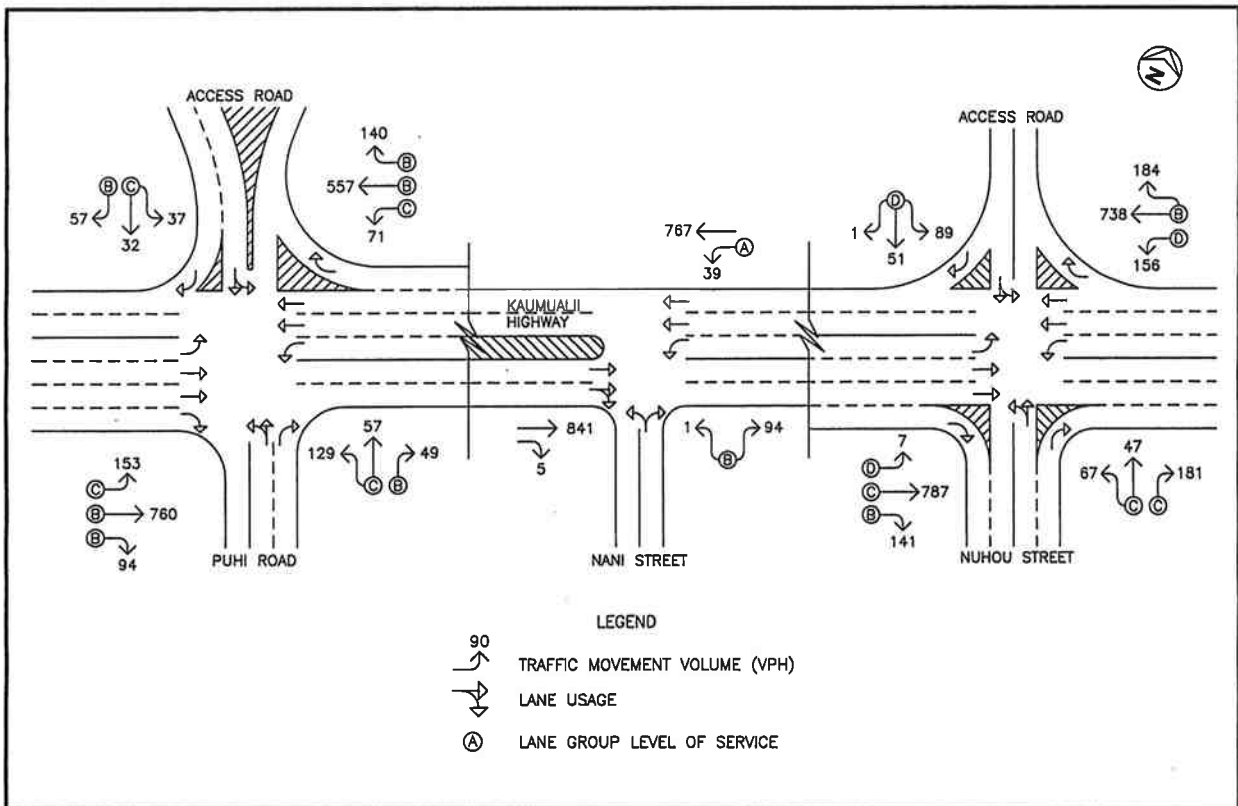
Traffic operations in the vicinity of Island School without the implementation of their master plan are expected to improve during both peak hours of traffic due to the widening of Kaumualii Highway to a four-lane divided highway. The traffic movements at the intersection of Kaumualii Highway with Puhi 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 Island School's master plan. The cumulative volumes consist of site-generated traffic superimposed over



 <p>WILSON OKAMOTO CORPORATION ENGINEERS • PLANNERS</p>	<b>ISLAND SCHOOL</b>	<b>FIGURE</b> 10
	<b>YEAR 2020 PM PEAK HOUR OF TRAFFIC WITH PROJECT</b>	



 <p>WILSON OKAMOTO CORPORATION ENGINEERS • PLANNERS</p>	<b>ISLAND SCHOOL</b>	<b>FIGURE</b> 9
	<b>YEAR 2020 AM PEAK HOUR OF TRAFFIC WITH PROJECT</b>	

Year 2020 projected traffic demands. The traffic impacts resulting from the proposed project are addressed in the following section.

**V. TRAFFIC IMPACT ANALYSIS**

The Year 2020 cumulative AM and PM peak hour traffic conditions with the implementation of Island School’s master 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 E.

**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	
Kaunualii Hwy/Puhi Rd	Eastbound	LT	C	C	D	D
		TH	B	B	B	B
		RT	B	B	B	B
	Westbound	LT	C	C	D	D
		TH	B	B	B	B
		RT	B	B	B	B
	Northbound	LT-TH	C	C	C	C
		RT	B	B	B	B
	Southbound	LT-TH	B	C	C	C
RT		B	B	B	B	
Kaunualii Hwy/Nani St	Westbound	LT	A	A	B	B
	Northbound	LT-RT	B	B	B	B
Kaunualii Hwy/Nuhou St	Eastbound	LT	D	D	D	D
		TH	B	C	B	B
		RT	B	B	B	B
	Westbound	LT	C	D	D	D
		TH-RT	B	B	B	B
	Northbound	LT-TH	C	C	C	C
		RT	C	C	B	B
	Southbound	LT-TH-RT	C	D	C	C

Traffic operations in the vicinity of Island School with the implementation of their master plan 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 southbound left-turn and through traffic movement at the intersection of Kaunualii Highway with Puhi Street is expected to operate at a slightly lower level of service during the AM peak period. Similarly, at the intersection of Kaunualii Highway with Nuhou Street, the eastbound through and westbound left-turn traffic movements, as well as, the southbound approach are expected to operate at slightly slower levels of service during the AM peak period. The remaining critical movements at these intersections, as well as, the other study intersection 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 2-3% during the AM peak period and less than 1% during the PM peak period with the proposed project. These increases in the total traffic volumes are in the range of daily volume fluctuations along Kaunualii 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 Island School’s master plan is not completed by the Year 2020, prepare an updated Traffic Impact Report that incorporates a revised project completion year.

**VII. CONCLUSION**

The master plan for Island School entails the expansion the private school’s campus over the next 10 years to provide additional classrooms and facilities. With the implementation of the aforementioned recommendations, Island School’s master plan is not

expected to have a significant impact on traffic operations in the vicinity. The traffic movements at the study intersections along Kaunualii 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 2-3% during the AM peak period and less than 1% during the PM peak period with the proposed project. These increases in the total traffic volumes are in the range of daily volume fluctuations along Kaunualii Highway and represent a minimal increase in the overall traffic volumes.

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**APPENDIX A**  
**EXISTING TRAFFIC COUNT DATA**

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### 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 PM  
Site Code : 00000001  
Start Date : 9/14/2010  
Page No : 1

Groups Printed- Unshifted

Start Time	KCC Driveway Southbound					Kaunualii Highway Westbound					Puhi Street Northbound					Kaunualii Highway Eastbound					Int. 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	
03:00 PM	43	6	21	0	70	19	171	8	0	198	37	4	22	3	66	4	160	34	2	200	534
03:15 PM	18	3	5	1	25	20	206	3	1	230	51	4	15	1	71	5	177	46	1	229	555
03:30 PM	18	4	6	0	28	8	234	4	0	246	46	4	17	0	67	2	193	30	0	225	568
03:45 PM	21	6	9	1	37	12	231	12	0	255	33	7	9	2	51	5	206	45	1	257	600
Total	98	19	41	2	160	59	842	27	1	929	167	19	63	6	255	16	736	155	4	911	2255
04:00 PM	15	5	13	0	33	12	226	11	0	249	51	6	19	0	76	14	189	37	0	240	598
04:15 PM	18	5	11	0	34	12	239	11	0	262	43	11	9	0	63	4	197	42	0	243	602
04:30 PM	38	5	23	0	66	4	228	17	0	249	48	8	8	0	64	16	198	44	1	259	638
04:45 PM	14	5	8	1	28	6	227	20	0	253	49	11	17	0	77	15	196	38	1	248	606
Total	85	20	55	1	161	34	920	59	0	1013	191	38	53	0	280	49	780	159	2	990	2444
05:00 PM	13	0	10	0	23	7	220	12	0	239	43	9	7	0	59	10	190	40	0	240	561
05:15 PM	5	4	10	0	19	6	223	11	0	240	55	4	12	0	71	2	198	23	1	224	564
05:30 PM	12	2	6	1	21	5	222	6	0	233	42	4	7	0	53	4	134	17	2	157	464
05:45 PM	2	0	6	0	8	8	173	13	0	194	30	4	20	0	54	9	202	37	0	248	504
Total	32	6	32	1	71	26	838	42	0	906	170	21	46	0	237	25	724	117	3	869	2083
Grand Total	215	45	128	4	392	119	2600	128	1	2848	528	78	162	6	772	90	2240	431	9	2770	6782
Apprch %	54.8	11.5	32.7	1		4.2	91.3	4.5	0		68.4	9.8	21	0.8		3.2	80.9	15.6	0.3		
Total %	3.2	0.7	1.9	0.1	5.8	1.8	88.3	1.9	0	42	7.8	1.1	2.4	0.1	11.4	1.3	33	6.4	0.1	40.8	

Start Time	KCC Driveway Southbound					Kaunualii Highway Westbound					Puhi Street Northbound					Kaunualii Highway Eastbound					Int. 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	
04:00 PM	15	5	13	0	33	12	226	11	0	249	51	6	19	0	76	14	189	37	0	240	598
04:15 PM	18	5	11	0	34	12	239	11	0	262	43	11	9	0	63	4	197	42	0	243	602
04:30 PM	38	5	23	0	66	4	228	17	0	249	48	8	8	0	64	16	198	44	1	259	638
04:45 PM	14	5	8	1	28	6	227	20	0	253	49	11	17	0	77	15	196	38	1	248	606
Total	85	20	55	1	161	34	920	59	0	1013	191	38	53	0	280	49	780	159	2	990	2444
% App. Total	53.1	12.5	34.4			3.4	90.8	5.8			68.2	12.9	18.9			5	78.9	16.1			
PHF	.559	1.000	.598	.608		.708	.982	.738	.967		.938	.818	.697	.909		.768	.985	.903	.957	.958	

### 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- Unshifted

Start Time	KCC Driveway Southbound					Kaunualii Highway Westbound					Puhi Street Northbound					Kaunualii Highway Eastbound					Int. 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	
06:00 AM	2	2	1	0	5	14	99	2	0	115	20	0	6	0	26	2	95	19	0	116	262
06:15 AM	1	1	1	1	4	28	181	3	0	210	38	0	4	2	42	9	152	17	2	180	436
06:30 AM	1	0	1	0	2	26	169	4	0	199	33	2	11	0	46	8	181	36	0	225	472
06:45 AM	3	2	0	0	5	30	128	12	0	170	25	2	9	0	36	9	208	40	0	257	488
Total	7	5	3	1	16	96	577	21	0	694	114	4	30	2	150	28	636	112	2	778	1638
07:00 AM	1	0	1	0	2	18	92	14	0	124	29	5	3	0	37	15	202	28	6	251	414
07:15 AM	8	1	7	0	16	25	149	21	0	195	28	11	19	0	58	18	200	23	3	244	513
07:30 AM	8	7	8	0	23	12	131	42	0	185	25	20	5	0	50	52	171	24	6	253	511
07:45 AM	14	14	18	0	46	16	128	43	1	188	34	16	9	1	60	35	163	21	4	223	515
Total	31	22	34	0	87	71	498	120	1	690	116	52	36	1	205	120	736	96	19	971	1953
08:00 AM	5	8	6	3	22	18	123	21	0	162	42	5	15	0	62	10	183	26	3	222	488
08:15 AM	7	2	0	0	9	20	126	26	0	172	27	10	13	0	50	16	179	49	1	245	478
08:30 AM	10	2	1	0	13	19	132	44	0	195	37	6	24	0	67	23	200	27	8	259	533
08:45 AM	7	2	6	0	15	16	121	55	0	192	21	12	25	0	58	24	167	32	0	223	488
Total	29	14	13	3	59	73	502	146	0	721	127	33	77	0	237	73	729	134	12	948	1955
Grand Total	67	41	60	4	162	240	1577	287	1	2105	357	89	143	3	592	221	2101	342	33	2697	5556
Apprch %	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	12.7	1.2		
Total %	1.2	0.7	0.9	0.1	2.9	4.3	28.4	5.2	0	37.9	6.4	1.6	2.6	0.1	10.7	4	37.8	6.2	0.6	48.5	

Start Time	KCC Driveway Southbound					Kaunualii Highway Westbound					Puhi Street Northbound					Kaunualii Highway Eastbound					Int. 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	
07:15 AM	8	1	7	0	16	25	149	21	0	195	28	11	19	0	58	18	200	23	0	241	510
07:30 AM	8	7	8	0	23	12	131	42	0	185	25	20	5	0	50	52	171	24	0	247	505
07:45 AM	14	14	18	0	46	16	128	43	1	188	34	16	9	1	60	35	163	21	0	219	509
08:00 AM	5	8	6	3	19	18	123	21	0	162	42	5	15	0	62	10	183	26	0	219	462
Total Volume	35	30	39	3	104	71	529	127	727	727	129	52	48	229	115	717	94	94	926	1988	
% App. Total	33.7	28.8	37.5			9.8	72.8	17.5			58.3	22.7	21			12.4	77.4	10.2			
PHF	.625	.536	.542	.665		.710	.888	.738	.932		.768	.650	.632	.923		.553	.896	.904	.937	.974	



**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- Unshifled

Start Time	Southbound App. Total	Kaumuali Highway Westbound					Nani Street Northbound					Kaumuali Highway Eastbound					Int. Total
		Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	
03:00 PM	0	11	199	0	0	210	1	0	8	0	9	0	212	5	0	217	436
03:15 PM	0	12	226	0	0	238	0	0	16	0	16	0	215	2	0	217	471
03:30 PM	0	6	244	0	0	250	1	0	17	0	18	0	222	1	0	223	491
03:45 PM	0	9	256	0	0	265	0	0	22	0	22	0	241	5	0	246	533
Total	0	38	925	0	0	963	2	0	63	0	65	0	890	13	0	903	1931
04:00 PM	0	7	244	0	0	251	0	0	16	0	16	0	220	2	0	222	489
04:15 PM	0	7	247	0	0	254	0	0	10	0	10	0	217	2	0	219	483
04:30 PM	0	11	242	0	0	253	1	0	11	0	12	0	235	3	0	238	503
04:45 PM	0	4	251	0	0	255	1	0	11	0	12	0	225	1	0	226	493
Total	0	29	984	0	0	1013	2	0	48	0	50	0	897	8	0	905	1968
05:00 PM	0	7	230	0	0	237	0	0	19	0	19	0	214	0	0	214	470
05:15 PM	0	8	235	1	0	244	0	0	13	0	13	0	225	3	0	228	485
05:30 PM	0	11	235	0	0	246	2	0	9	1	12	0	166	2	0	168	426
05:45 PM	0	3	196	0	0	199	0	0	11	0	11	0	222	2	0	224	434
Total	0	29	896	1	0	926	2	0	52	1	55	0	827	7	0	834	1815
Grand Total	0	96	2805	1	0	2902	6	0	163	1	170	0	2614	28	0	2642	5714
Approch %	0	3.3	96.7	0	0		3.5	0	95.9	0.6		0	98.9	1.1	0		
Total %	0	1.7	49.1	0	0	60.8	0.1	0	2.9	0	3	0	45.7	0.5	0	46.2	

Start Time	Southbound App. Total	Kaumuali Highway Westbound					Nani Street Northbound					Kaumuali Highway Eastbound					Int. Total
		Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	
Peak Hour Analysis From 03:00 PM to 05:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 03:45 PM																	
03:45 PM	0	9	256	0	0	265	0	0	22	0	22	0	241	5	0	246	533
04:00 PM	0	7	244	0	0	251	0	0	16	0	16	0	220	2	0	222	489
04:15 PM	0	7	247	0	0	254	0	0	10	0	10	0	217	2	0	219	483
04:30 PM	0	11	242	0	0	253	1	0	11	0	12	0	235	3	0	238	503
04:45 PM	0	4	251	0	0	255	1	0	11	0	12	0	225	1	0	226	493
Total Volume	0	34	989	0	0	1023	2	0	59	0	60	0	913	12	0	925	2008
% App. Total		3.3	96.7	0	0		1.7	0	59.3	0		0	98.7	1.3	0		
PHF	.000	.773	.966	.000	.965	.250	.000	.670	.682	.000	.947	.800	.940	.942			

**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- Unshifled

Start Time	Southbound App. Total	Kaumuali Highway Westbound					Nani Street Northbound					Kaumuali Highway Eastbound					Int. Total
		Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	
06:00 AM	0	0	110	0	0	110	3	0	13	0	16	0	109	2	0	111	237
06:15 AM	0	3	210	0	0	213	1	0	11	2	14	0	149	0	0	149	376
06:30 AM	0	6	197	0	0	203	1	0	8	2	11	0	197	2	0	199	413
06:45 AM	0	7	170	0	0	177	0	0	14	0	14	0	220	0	0	220	411
Total	0	16	687	0	0	703	5	0	46	4	55	0	675	4	0	679	1437
07:00 AM	0	10	127	0	0	137	0	0	19	0	19	0	213	2	0	215	371
07:15 AM	0	11	191	0	0	202	0	0	28	0	28	0	223	0	0	223	453
07:30 AM	0	6	184	0	0	190	0	0	26	0	26	0	192	2	0	194	410
07:45 AM	0	10	178	0	0	188	1	0	19	0	20	0	190	0	0	190	398
Total	0	37	680	0	0	717	1	0	92	0	93	0	818	4	0	822	1632
08:00 AM	0	11	166	0	0	177	0	0	21	0	21	0	205	3	0	208	406
08:15 AM	0	10	168	0	0	178	1	0	12	0	13	0	224	2	0	226	417
08:30 AM	0	5	192	0	0	197	0	0	17	0	17	0	235	0	0	235	449
08:45 AM	0	9	194	0	0	203	1	0	16	0	17	0	199	6	0	205	425
Total	0	35	720	0	0	755	2	0	66	0	68	0	863	11	0	874	1697
Grand Total	0	88	2087	0	0	2175	8	0	204	4	216	0	2356	19	0	2375	4768
Approch %	0	4	96	0	0		3.7	0	94.4	1.9		0	99.2	0.8	0		
Total %	0	1.8	43.8	0	0	45.6	0.2	0	4.3	0.1	4.5	0	49.4	0.4	0	49.8	

Start Time	Southbound App. Total	Kaumuali Highway Westbound					Nani Street Northbound					Kaumuali Highway Eastbound					Int. Total
		Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	
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	166	0	0	177	0	0	21	0	21	0	205	3	0	208	406
08:15 AM	0	10	168	0	0	178	1	0	12	0	13	0	224	2	0	226	417
08:30 AM	0	5	192	0	0	197	0	0	17	0	17	0	235	0	0	235	449
08:45 AM	0	9	194	0	0	203	1	0	16	0	17	0	199	6	0	205	425
Total Volume	0	35	720	0	0	755	2	0	66	0	68	0	863	11	0	874	1697
% App. Total		4.6	95.4	0	0		2.9	0	97.1	0		0	98.7	1.3	0		
PHF	.000	.795	.928	.000	.930	.500	.000	.786	.810	.000	.918	.458	.930	.945			



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

Page 1

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

Start Time	14-Sep-10 Tue		NB		Hour Totals		SB		Hour Totals		Combined Totals		
	Morning	Afternoon	Morning	Afternoon	Morning	Afternoon	Morning	Afternoon	Morning	Afternoon	Morning	Afternoon	
12:00		41											
12:15		22											
12:30		16											
12:45		14			0	93			0	135	0	228	
01:00		20											
01:15		28											
01:30		28											
01:45		20			0	96			0	147	0	243	
02:00		26											
02:15		22											
02:30		36											
02:45		28			0	112			0	162	0	274	
03:00		26											
03:15		10											
03:30		13											
03:45		21			0	70			0	148	0	218	
04:00		28											
04:15		27											
04:30		27											
04:45		49			0	131			0	129	0	260	
05:00		38											
05:15		20											
05:30		12											
05:45		26			0	96			0	72	0	168	
06:00		14											
06:15		9											
06:30		15											
06:45		10			0	48			0	85	0	133	
07:00		4											
07:15		1											
07:30		3											
07:45		3			0	11			0	63	0	74	
08:00		6											
08:15		1											
08:30		3											
08:45		0			0	10			0	119	0	129	
09:00		1											
09:15		0											
09:30		0											
09:45		0			0	1			0	16	0	17	
10:00		0											
10:15		0											
10:30		52					24						
10:45		56			108	0	49		73	0	181	0	
11:00		21					18						
11:15		14					16						
11:30		28					18						
11:45		36			99	3	20		72	1	171	4	
<b>Total</b>		<b>207</b>		<b>671</b>			<b>145</b>		<b>1077</b>			<b>352</b>	<b>1748</b>
<b>Percent</b>		<b>23.6%</b>		<b>76.4%</b>			<b>11.9%</b>		<b>88.1%</b>			<b>16.8%</b>	<b>83.2%</b>

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

Page 2

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

Start Time	15-Sep-10 Wed		NB		Hour Totals		SB		Hour Totals		Combined Totals		
	Morning	Afternoon	Morning	Afternoon	Morning	Afternoon	Morning	Afternoon	Morning	Afternoon	Morning	Afternoon	
12:00		0		27									
12:15		0		19									
12:30		0		24									
12:45		0		28			0		98				
01:00		0		31									
01:15		1		53									
01:30		0		32									
01:45		0		25			1		141				
02:00		0		24									
02:15		0		29									
02:30		0		28									
02:45		0		31			0		112				
03:00		0		18									
03:15		0		17									
03:30		0		15									
03:45		1		30			1		80				
04:00		0		25									
04:15		0		33									
04:30		0		46									
04:45		0		58			0		162				
05:00		1		44									
05:15		1		22									
05:30		1		8									
05:45		4		15			7		89				
06:00		4		14									
06:15		12		19									
06:30		12		16									
06:45		21		14			49		63				
07:00		26		4									
07:15		44		8									
07:30		99		6									
07:45		120		5			289		23				
08:00		42		3									
08:15		47		0									
08:30		51		1									
08:45		110		1			250		5				
09:00		41		0									
09:15		17		0									
09:30		41		2									
09:45		58		1			157		3				
10:00		30		0									
10:15		17		2									
10:30		27		0									
10:45		43		0			117		2				
11:00		26		0									
11:15		33		0									
11:30		24		0									
11:45		36		1			119		1				
<b>Total</b>		<b>990</b>		<b>779</b>			<b>420</b>		<b>1146</b>			<b>1410</b>	<b>1925</b>
<b>Percent</b>		<b>56.0%</b>		<b>44.0%</b>			<b>26.8%</b>		<b>73.2%</b>			<b>42.3%</b>	<b>57.7%</b>

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

Start Time	16-Sep-10 Thu	NB		Hour Totals		SB		Hour Totals		Combined Totals	
		Morning	Afternoon	Morning	Afternoon	Morning	Afternoon	Morning	Afternoon	Morning	Afternoon
12:00		1				2					
12:15		0				0					
12:30		0				0					
12:45		0		1	0	0		2	0	3	0
01:00		0				0					
01:15		0				0					
01:30		0				0					
01:45		0		0	0	0		0	0	0	0
02:00		0				0					
02:15		0				0					
02:30		0		0	0	0		0	0	0	0
02:45		0				1					
03:00		0				0					
03:15		0				0					
03:30		0				0					
03:45		0		0	0	0		1	0	1	0
04:00		0				0					
04:15		0				0					
04:30		1				0					
04:45		0		1	0	0		0	0	1	0
05:00		0				0					
05:15		1				0					
05:30		0				0					
05:45		2		3	0	0		0	0	3	0
06:00		5				3					
06:15		6				3					
06:30		7				2					
06:45		13		31	0	4		12	0	49	0
07:00		10				2					
07:15		49				10					
07:30		104				26					
07:45		121		284	0	31		69	0	353	0
08:00		51				28					
08:15		35				4					
08:30		28				8					
08:45		44		158	0	14		54	0	212	0
09:00		74				6					
09:15		31				5					
09:30		.		.	.	.		.	.	.	.
09:45		.		.	.	.		.	.	.	.
10:00		.		.	.	.		.	.	.	.
10:15		.		.	.	.		.	.	.	.
10:30		.		.	.	.		.	.	.	.
10:45		.		.	.	.		.	.	.	.
11:00		.		.	.	.		.	.	.	.
11:15		.		.	.	.		.	.	.	.
11:30		.		.	.	.		.	.	.	.
11:45		.		.	.	.		.	.	.	.
<b>Total</b>		<b>583</b>	<b>0</b>			<b>149</b>	<b>0</b>			<b>616</b>	<b>0</b>
<b>Percent</b>		<b>100.0%</b>	<b>0.0%</b>			<b>100.0%</b>	<b>0.0%</b>			<b>100.0%</b>	<b>0.0%</b>
<b>Grand Total</b>		<b>1780</b>	<b>1450</b>			<b>714</b>	<b>2223</b>			<b>2378</b>	<b>3673</b>
<b>Percent</b>		<b>55.1%</b>	<b>44.9%</b>			<b>24.3%</b>	<b>75.7%</b>			<b>39.3%</b>	<b>60.7%</b>
<b>ADT</b>		<b>ADT 3,335</b>				<b>ADT 3,335</b>					

**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 E** describes operation with control delay greater than 55 and up to 80 sec per vehicle. These high delay values generally indicate poor progression, long cycle lengths, and high v/c ratios. Individual cycle failures are frequent.

**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 DEFINITIONS

### LEVEL-OF-SERVICE CRITERIA FOR UNSIGNALIZED INTERSECTIONS

**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  
Unsignalized Intersections**

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

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## APPENDIX C

### CAPACITY ANALYSIS CALCULATIONS EXISTING PEAK HOUR TRAFFIC ANALYSIS

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HCM Signalized Intersection Capacity Analysis

3: Kaunualii & KCC

12/3/2010



Lane Configurations	↔	↑	↔	↓	↔	↑	↔	↓	↔	↑	↔	↓
Volume (vph)	115	724	94	71	530	127	129	52	49	35	30	39
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	4.0
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	1.00
Flt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.85	1.00	0.85	1.00	0.85
Flt 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	1863	1583	1770	1863	1583	1799	1583	1814	1583	1799	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.71	1.00	0.68	1.00	0.68	1.00
Satd. Flow (perm)	1770	1863	1583	1770	1863	1583	1317	1583	1276	1583	1276	1583
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	0.57
Adj. Flow (vph)	122	770	100	76	570	137	140	57	53	61	53	68
RTOR Reduction (vph)	0	0	19	0	0	36	0	0	40	0	0	0
Lane Group Flow (vph)	122	770	81	76	570	101	0	197	13	0	114	68
Turn Type	Prot	Perm	Prot	Perm	Perm	Perm	Perm	Perm	Perm	Free	Free	Free
Protected Phases	7	4	3	8	8	2	2	2	6	6	6	Free
Permitted Phases			4		8							Free
Actuated Green, G (s)	14.4	56.2	56.2	8.6	50.4	50.4		25.4	25.4		25.4	105.2
Effective Green, g (s)	14.4	56.2	56.2	8.6	50.4	50.4		25.4	25.4		25.4	105.2
Actuated g/C Ratio	0.14	0.53	0.53	0.08	0.48	0.48		0.24	0.24		0.24	1.00
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)	242	995	846	145	893	758		318	382		308	1583
v/s Ratio Prot	c0.07	c0.41		0.04	0.31			c0.15	0.01		0.09	0.04
v/s Ratio Perm			0.05		0.06				0.03			0.04
v/c Ratio	0.50	0.77	0.10	0.52	0.64	0.13		0.62	0.03		0.37	0.04
Uniform Delay, d1	42.1	19.5	12.0	46.3	20.6	15.2		35.6	30.5		33.2	0.0
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	1.7	3.8	0.0	3.4	1.5	0.1		3.6	0.0		0.8	0.1
Delay (s)	43.7	23.3	12.1	49.7	22.1	15.3		39.2	30.5		34.0	0.1
Level of Service	D	C	B	D	C	B		D	C		C	A
Approach Delay (s)		24.7			23.6			37.3			21.3	
Approach LOS		C			C			D			C	

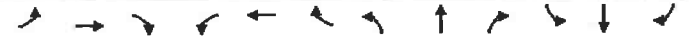
HCM Average Control Delay	25.4	HCM Level of Service	C
HCM Volume to Capacity ratio	0.72		
Actuated Cycle Length (s)	105.2	Sum of lost time (s)	15.0
Intersection Capacity Utilization	71.1%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

3: Kaunualii & KCC

12/3/2010



Lane Configurations	↔	↑	↔	↓	↔	↑	↔	↓	↔	↑	↔	↓
Volume (vph)	49	788	159	34	919	59	191	36	54	85	20	55
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	4.0
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	1.00
Flt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.85	1.00	0.85	1.00	0.85
Flt 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	1863	1583	1770	1863	1583	1788	1583	1790	1583	1790	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.56	1.00	0.44	1.00	0.44	1.00
Satd. Flow (perm)	1770	1863	1583	1770	1863	1583	1035	1583	823	1583	823	1583
Peak-hour factor, PHF	0.96	0.96	0.96	0.97	0.97	0.97	0.91	0.91	0.91	0.61	0.61	0.61
Adj. Flow (vph)	51	821	166	35	947	61	210	40	59	139	33	90
RTOR Reduction (vph)	0	0	28	0	9	0	0	42	0	0	0	0
Lane Group Flow (vph)	51	821	138	35	947	52	0	250	17	0	172	90
Turn Type	Prot	Perm	Prot	Perm	Perm	Perm	Perm	Perm	Perm	Free	Free	Free
Protected Phases	7	4	3	8	8	2	2	2	6	6	6	Free
Permitted Phases			4		8							Free
Actuated Green, G (s)	7.2	84.8	84.8	5.6	83.2	83.2		43.4	43.4		43.4	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
Actuated g/C Ratio	0.05	0.57	0.57	0.04	0.56	0.56		0.29	0.29		0.29	1.00
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)	86	1062	902	67	1042	885		302	462		240	1583
v/s Ratio Prot	c0.03	0.44		0.02	c0.51			c0.24	0.01		0.21	c0.06
v/s Ratio Perm			0.09			0.03			0.01			0.04
v/c Ratio	0.59	0.77	0.15	0.52	0.91	0.06		0.83	0.04		0.72	0.06
Uniform Delay, d1	69.4	24.6	15.1	70.3	29.4	15.0		49.2	37.7		47.2	0.0
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	10.5	3.6	0.1	7.2	11.3	0.0		16.8	0.0		9.8	0.1
Delay (s)	79.9	28.2	15.2	77.5	40.7	15.0		66.0	37.8		57.0	0.1
Level of Service	E	C	B	E	D	B		E	D		E	A
Approach Delay (s)		28.6			40.5			60.6			37.4	
Approach LOS		C			D			E			D	

HCM Average Control Delay	37.9	HCM Level of Service	D
HCM Volume to Capacity ratio	0.87		
Actuated Cycle Length (s)	148.8	Sum of lost time (s)	15.0
Intersection Capacity Utilization	75.8%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Unsignalized Intersection Capacity Analysis

9: Kaunualii & Nani

12/3/2010



Lane Configurations	803	5	39	727	1	94
Volume (veh/h)	Free				Free	Stop
Sign Control						
Grade	0%				0%	0%
Peak Hour Factor	0.91	0.91	0.94	0.94	0.85	0.85
Hourly flow ratio (yph)	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				0.60	0.60
pX, platoon unblocked					888	1742
vC, conflicting volume						885
vC1, stage 1 cont vol						
vC2, stage 2 cont vol					484	1901
vCu, unblocked vol					4.1	*5.4
IC, single (s)					2.2	3.5
IC, 2 stage (s)					94	98
IF (s)					650	73
p0 queue free %						73
cM capacity (veh/h)						405

Volume Total	888	815	112
Volume Left	0	41	1
Volume Right	5	0	111
cSH	1700	650	386
Volume to Capacity	0.52	0.06	0.29
Queue Length 95th (ft)	0	5	30
Control Delay (s)	0.0	1.8	18.1
Lane LOS	A	A	C
Approach Delay (s)	0.0	1.8	18.1
Approach LOS	C	C	C

Average Delay	1.9		
Intersection Capacity Utilization	82.6%		ICU Level of Service
Analysis Period (min)	15		E

• User Entered Value

HCM Unsignalized Intersection Capacity Analysis

9: Kaunualii & Nani

12/3/2010



Lane Configurations	919	8	30	1010	2	49
Volume (veh/h)	Free				Free	Stop
Sign Control						
Grade	0%				0%	0%
Peak Hour Factor	0.95	0.95	0.99	0.99	0.78	0.78
Hourly flow ratio (yph)	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				0.61	0.61
pX, platoon unblocked					976	2052
vC, conflicting volume						972
vC1, stage 1 cont vol						
vC2, stage 2 cont vol					646	2400
vCu, unblocked vol					4.1	*5.4
IC, single (s)					2.2	3.5
IC, 2 stage (s)					95	94
IF (s)					577	42
p0 queue free %						82
cM capacity (veh/h)						350

Volume Total	976	1051	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)	0.0	1.8	22.4
Lane LOS	A	A	C
Approach Delay (s)	0.0	1.8	22.4
Approach LOS	C	C	C

Average Delay	1.6		
Intersection Capacity Utilization	87.3%		ICU Level of Service
Analysis Period (min)	15		E

• User Entered Value



HCM Signalized Intersection Capacity Analysis  
6: Kaunualii & KCC

12/3/2010



Lane Configurations	↖	↑	↗	↖	↑	↗	↖	↑	↗	↖	↑	↗
Volume (vph)	7	749	141	156	698	154	67	35	181	74	38	1
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	1.00	1.00	1.00	1.00			1.00	1.00			1.00
Frt	1.00	1.00	0.85	1.00	0.97			1.00	0.85			1.00
Flt Protected	0.95	1.00	1.00	0.95	1.00			0.97	1.00			0.97
Satd. Flow (prot)	1770	1863	1583	1770	1812			1803	1583			1801
Flt Permitted	0.95	1.00	1.00	0.95	1.00			0.71	1.00			0.62
Satd. Flow (perm)	1770	1863	1583	1770	1812			1323	1583			1147
Peak-hour factor, PHF	0.91	0.91	0.91	0.88	0.88	0.88	0.71	0.71	0.71	0.58	0.58	0.58
Adj. Flow (vph)	8	823	155	177	793	175	94	49	255	128	66	2
RTOR Reduction (vph)	0	0	26	0	4	0	0	0	199	0	0	0
Lane Group Flow (vph)	8	823	129	177	964	0	0	143	56	0	196	0
Turn Type	Prot		Perm	Prot		Perm		Perm		Perm		Perm
Protected Phases	7		4	3		8		2		2		6
Permitted Phases				4			2		2		6	
Actuated Green, G (s)	1.8	72.9	72.9	19.5	90.6			30.2	30.2			30.2
Effective Green, g (s)	1.8	72.9	72.9	19.5	90.6			30.2	30.2			30.2
Actuated g/C Ratio	0.01	0.53	0.53	0.14	0.66			0.22	0.22			0.22
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)	23	987	839	251	1193			290	347			252
v/s Ratio Prot	0.00	0.44		c0.10	c0.53							
v/s Ratio Perm			0.08			0.11	0.04			c0.17		
v/c Ratio	0.35	0.83	0.15	0.71	0.81	0.49	0.16			0.78		
Uniform Delay, d1	67.3	27.2	16.6	56.3	17.2	47.0	43.5			50.5		
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00			1.00		
Incremental Delay, d2	8.9	6.2	0.1	8.7	4.1	1.3	0.2			14.0		
Delay (s)	76.2	33.4	16.6	65.0	21.3	48.3	43.7			64.5		
Level of Service	E	C	B	E	C	D	D			E		
Approach Delay (s)		31.1			28.0		45.3			64.5		
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)	137.6	Sum of lost time (s)	15.0
Intersection Capacity Utilization	74.7%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis  
6: Kaunualii & KCC

12/3/2010



Lane Configurations	↖	↑	↗	↖	↑	↗	↖	↑	↗	↖	↑	↗	↖	↑	↗
Volume (vph)	9	840	119	148	844	65	183	26	76	75	26	13			
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	1.00	1.00	1.00	1.00			1.00	1.00			1.00			
Frt	1.00	1.00	0.85	1.00	0.99			1.00	0.85			0.98			
Flt Protected	0.95	1.00	1.00	0.95	1.00			0.96	1.00			0.97			
Satd. Flow (prot)	1770	1863	1583	1770	1843			1785	1583			1776			
Flt Permitted	0.95	1.00	1.00	0.95	1.00			0.67	1.00			0.50			
Satd. Flow (perm)	1770	1863	1583	1770	1843			1249	1583			920			
Peak-hour factor, PHF	0.95	0.95	0.95	0.96	0.96	0.96	0.91	0.91	0.91	0.84	0.84	0.84			
Adj. Flow (vph)	9	884	125	50	879	68	201	29	84	89	31	15			
RTOR Reduction (vph)	0	0	21	0	2	0	0	0	63	0	2	0			
Lane Group Flow (vph)	9	884	104	50	945	0	0	230	21	0	133	0			
Turn Type	Prot		Perm	Prot		Perm		Perm		Perm		Perm			
Protected Phases	7		4	3		8		2		2		6			
Permitted Phases				4			2		2		6				
Actuated Green, G (s)	1.5	70.8	70.8	6.7	76.0			31.2	31.2			31.2			
Effective Green, g (s)	1.5	70.8	70.8	6.7	76.0			31.2	31.2			31.2			
Actuated g/C Ratio	0.01	0.57	0.57	0.05	0.61			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			
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0			3.0	3.0			3.0			
Lane Grp Cap (vph)	21	1066	906	96	1132			315	399			232			
v/s Ratio Prot	0.01	0.47		c0.03	c0.51										
v/s Ratio Perm			0.07					c0.18	0.01			0.14			
v/c Ratio	0.43	0.83	0.12	0.52	0.84			0.73	0.05			0.57			
Uniform Delay, d1	60.7	21.5	12.1	56.9	18.9			42.4	35.1			40.4			
Progression Factor	1.00	1.00	1.00	1.00	1.00			1.00	1.00			1.00			
Incremental Delay, d2	13.4	5.5	0.1	5.0	5.5			8.4	0.1			3.4			
Delay (s)	74.1	27.0	12.2	62.0	24.4			50.8	35.1			43.8			
Level of Service	E	C	B	E	C			D	D			D			
Approach Delay (s)		25.6			26.2			46.6				43.8			
Approach LOS		C			C			D				D			

HCM Average Control Delay	29.5	HCM Level of Service	C
HCM Volume to Capacity ratio	0.81		
Actuated Cycle Length (s)	123.7	Sum of lost time (s)	15.0
Intersection Capacity Utilization	71.7%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis  
3: Kaunualii & KCC

12/3/2010



**APPENDIX D**  
**CAPACITY ANALYSIS CALCULATIONS**  
**PROJECTED YEAR 2020 PEAK HOUR TRAFFIC**  
**ANALYSIS WITHOUT PROJECT**

Lane Configurations	↖	↕	↗	↖	↕	↗	↖	↕	↗	↖	↕	↗
Volume (vph)	126	760	94	71	557	140	129	57	49	37	32	41
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	0.95	1.00	1.00	1.00	1.00	1.00
Flt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.85	1.00	0.85	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.97	1.00	1.00	0.97	1.00	1.00
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583	1800	1583	1814	1583	1814	1583
Flt 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	1339	1583	1402	1583	1402	1583
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	0.57
Adj. Flow (vph)	134	809	100	76	599	151	140	62	53	65	56	72
RTOR Reduction (vph)	0	0	51	0	0	97	0	0	39	0	0	53
Lane Group Flow (vph)	134	809	49	76	599	54	0	202	14	0	121	19
Turn Type	Prot	Perm	Prot	Perm	Perm	Perm	Perm	Perm	Perm	Perm	Perm	Perm
Protected Phases	7	4	3	8	8	2	2	2	6	6	6	6
Permitted Phases			4			2		2				
Actuated Green, G (s)	8.8	24.7	24.7	6.9	22.8	22.8	16.9	16.9	16.9	16.9	16.9	16.9
Effective Green, g (s)	8.8	24.7	24.7	6.9	22.8	22.8	16.9	16.9	16.9	16.9	16.9	16.9
Actuated g/C Ratio	0.14	0.39	0.39	0.11	0.36	0.36	0.27	0.27	0.27	0.27	0.27	0.27
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)	245	1377	616	192	1271	568	356	421	373	421	373	421
v/s Ratio Prot	c0.08	c0.23		0.04	0.17							
v/s Ratio Perm			0.03		0.03		c0.15	0.01	0.09	0.01	0.09	0.01
v/c Ratio	0.55	0.59	0.08	0.40	0.47	0.10	0.57	0.03	0.32	0.03	0.32	0.05
Uniform Delay, d1	25.5	15.4	12.2	26.4	15.7	13.5	20.1	17.3	18.7	17.3	18.7	17.3
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	2.5	0.6	0.1	1.3	0.3	0.1	2.1	0.0	0.5	0.0	0.5	0.0
Delay (s)	28.0	16.0	12.3	27.7	16.0	13.6	22.2	17.3	19.2	17.3	19.2	17.4
Level of Service	C	B	B	C	B	B	C	B	B	B	B	B
Approach Delay (s)		17.2			16.6		21.2		18.5		18.5	
Approach LOS		B			B		C		B		B	
HCM Average Control Delay			17.5			HCM Level of Service		B				
HCM Volume to Capacity ratio			0.54			Sum of lost time (s)		10.0				
Actuated Cycle Length (s)			63.5			ICU Level of Service		A				
Intersection Capacity Utilization			54.2%									
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis  
3: Kaumualii & KCC

12/3/2010



Lane Configurations	7	8	9	10	11	12	13	14	15	16	17	
Volume (vph)	56	827	159	34	965	68	191	42	54	92	22	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	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	1.00
Flt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.85	1.00	0.85	1.00	0.85
Flt 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	1789	1583	1790	1583	1790	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.61	1.00	0.61	1.00	0.51	1.00
Satd. Flow (perm)	1770	3539	1583	1770	3539	1583	1141	1583	958	1583	958	1583
Peak-hour factor, PHF	0.96	0.96	0.96	0.97	0.97	0.97	0.91	0.91	0.61	0.91	0.61	0.61
Adj. Flow (vph)	58	861	166	35	995	70	210	46	59	151	36	97
RTOR Reduction (vph)	0	0	72	0	0	27	0	0	0	0	0	66
Lane Group Flow (vph)	58	861	94	35	995	43	0	256	19	0	187	31
Turn Type	Prot	Perm	Prot	Perm	Perm	Perm	Perm	Perm	Perm	Perm	Perm	Perm
Protected Phases	7	4		3	8		2	2		6	6	6
Permitted Phases			4		8	2		2	6			6
Actuated Green, G (s)	5.7	35.7	35.7	3.0	33.0	33.0	25.3	25.3		25.3	25.3	25.3
Effective Green, g (s)	5.7	35.7	35.7	3.0	33.0	33.0	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
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)	128	1599	715	67	1478	661	365	507		307	507	
v/s Ratio Prot	0.03	0.24		0.02	0.28							
v/s Ratio Perm			0.06		0.03		0.22	0.01		0.20	0.02	
v/c Ratio	0.45	0.54	0.13	0.52	0.67	0.06	0.70	0.04		0.61	0.06	
Uniform Delay, d1	35.2	15.7	12.6	37.3	18.6	13.8	23.5	18.5		22.7	18.6	
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	2.5	0.4	0.1	7.2	1.2	0.0	6.0	0.0		3.4	0.1	
Delay (s)	37.7	16.0	12.7	44.5	19.9	13.8	29.5	18.5		26.1	18.7	
Level of Service	D	B	B	D	B	B	C	B		C	B	
Approach Delay (s)		16.7			20.3		27.5			23.5		
Approach LOS		B			C		C			C		
HCM Average Control Delay		20.0										C
HCM Volume to Capacity ratio		0.72										
Actuated Cycle Length (s)		79.0					20.0					
Intersection Capacity Utilization		62.0%										B
Analysis Period (min)		15										
c Critical Lane Group												

HCM Unsignalized Intersection Capacity Analysis  
9: Kaumualii & Nani

12/3/2010



Lane Configurations	1	2	3	4	5	6
Volume (veh/h)	841	5	39	767	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)	924	5	41	816	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			0.89		0.89	0.89
vC, conflicting volume			930		1418	465
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			675		1223	153
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		99	86
cM capacity (veh/h)			812		145	771
Volume Total	616	314	41	408	408	112
Volume Left	0	0	41	0	0	1
Volume Right	0	5	0	0	0	111
cSH	1700	1700	812	1700	1700	738
Volume to Capacity	0.36	0.18	0.05	0.24	0.24	0.15
Queue Length 95th (ft)	0	0	4	0	0	13
Control Delay (s)	0.0	0.0	9.7	0.0	0.0	10.8
Lane LOS			A			B
Approach Delay (s)	0.0		0.5			10.8
Approach LOS						B
Average Delay			0.8			
Intersection Capacity Utilization			42.6%			
Analysis Period (min)			15			
ICU Level of Service						A

HCM Unsignalized Intersection Capacity Analysis

9: Kaumualii & Nani

12/3/2010



Lane Configurations	↕↕		↕		↕↕		↕		↕	
Volume (veh/h)	965	8	30	1065	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			0.88	0.88	0.88					
vC, conflicting volume			1024	1618	512					
vC1, stage 1 conf vol										
vC2, stage 2 conf vol										
vCu, unblocked vol			754	1429	171					
tC, single (s)			4.1	6.8	6.9					
tC, 2 stage (s)										
IF (s)			2.2	3.5	3.3					
p0 queue free %			96	98	92					
cM capacity (veh/h)			750	106	741					

Volume Total	677	347	30	538	538	65
Volume Left	0	0	30	0	0	3
Volume Right	0	8	0	0	0	63
cSH	1700	1700	750	1700	1700	600
Volume to Capacity	0.40	0.20	0.04	0.32	0.32	0.11
Queue Length 95th (ft)	0	0	3	0	0	9
Control Delay (s)	0.0	0.0	10.0	0.0	0.0	11.7
Lane LOS			B			B
Approach Delay (s)	0.0		0.3			11.7
Approach LOS						B

Average Delay			0.5			
Intersection Capacity Utilization			39.4%		ICU Level of Service	A
Analysis Period (min)			15			

HCM Signalized Intersection Capacity Analysis

6: Kaumualii & KCC

12/3/2010



Lane Configurations	↕		↕↕		↕		↕↕		↕		↕↕		↕	
Volume (vph)	7	787	141	156	738	154	67	35	181	74	38	1		
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	0.95	1.00	1.00	0.95			1.00	1.00			1.00		
Flt	1.00	1.00	0.85	1.00	0.97			1.00	0.85			1.00		
Flt Protected	0.95	1.00	1.00	0.95	1.00			0.97	1.00			0.97		
Satd. Flow (prot)	1770	3539	1583	1770	3448			1803	1583			1801		
Flt Permitted	0.95	1.00	1.00	0.95	1.00			0.71	1.00			0.70		
Satd. Flow (perm)	1770	3539	1583	1770	3448			1327	1583			1306		
Peak-hour factor, PHF	0.91	0.91	0.91	0.88	0.88	0.88	0.71	0.71	0.71	0.58	0.58	0.58	0.58	
Adj. Flow (vph)	8	865	155	177	839	175	94	49	255	128	66	2		
RTOR Reduction (vph)	0	0	67	0	12	0	0	0	196	0	0	0		
Lane Group Flow (vph)	8	865	88	177	1002	0	0	143	59	0	196	0		
Turn Type	Prot		Perm		Prot		Perm		Perm		Perm		Perm	
Protected Phases	7		4		3		8		2		6		6	
Permitted Phases			4				2		2		6			
Actuated Green, G (s)	1.0	33.8	33.8	14.1	46.9			18.8	18.8			18.8		
Effective Green, g (s)	1.0	33.8	33.8	14.1	46.9			18.8	18.8			18.8		
Actuated g/C Ratio	0.01	0.41	0.41	0.17	0.57			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		
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0			3.0	3.0			3.0		
Lane Grp Cap (vph)	22	1464	655	305	1979			305	364			301		
v/s Ratio Prot	0.00	c0.24		c0.10	0.29									
v/s Ratio Perm			0.06					0.11	0.04			c0.15		
v/c Ratio	0.36	0.59	0.13	0.58	0.51			0.47	0.16			0.65		
Uniform Delay, d1	40.0	18.6	14.9	31.1	10.4			27.1	25.1			28.5		
Progression Factor	1.00	1.00	1.00	1.00	1.00			1.00	1.00			1.00		
Incremental Delay, d2	9.9	0.6	0.1	2.8	0.2			1.1	0.2			5.0		
Delay (s)	50.0	19.2	15.0	33.9	10.7			28.3	25.4			33.5		
Level of Service	D	B	B	C	B			C	C			C		
Approach Delay (s)		18.8			14.1			26.4				33.5		
Approach LOS		B			B			C				C		

HCM Average Control Delay	18.9	HCM Level of Service	B
HCM Volume to Capacity ratio	0.61		
Actuated Cycle Length (s)	81.7	Sum of lost time (s)	15.0
Intersection Capacity Utilization	55.7%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis

6: Kaunualii & KCC

12/3/2010



Lane Configurations	↖	↑↑	↑	↗	↖	↑	↗	↖	↑	↗	↖	↑	↗
Volume (vph)	9	886	119	48	899	65	183	26	76	75	26	13	
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	0.95	1.00	1.00	0.95			1.00	1.00		1.00		
Fit	1.00	1.00	0.85	1.00	0.99			1.00	0.85		0.98		
Fit Protected	0.95	1.00	1.00	0.95	1.00			0.96	1.00		0.97		
Satd. Flow (prot)	1770	3539	1583	1770	3503			1785	1583		1776		
Fit Permitted	0.95	1.00	1.00	0.95	1.00			0.69	1.00		0.64		
Satd. Flow (perm)	1770	3539	1583	1770	3503			1287	1583		1166		
Peak-hour factor, PHF	0.95	0.95	0.95	0.96	0.96	0.96	0.91	0.91	0.91	0.84	0.84	0.84	
Adj. Flow (vph)	9	933	125	50	936	68	201	29	84	89	31	15	
RTOR Reduction (vph)	0	0	50	0	4	0	0	0	60	0	4	0	
Lane Group Flow (vph)	9	933	75	50	1000	0	0	230	24	0	131	0	
Turn Type	Prot		Perm	Prot		Perm		Perm	Perm		Perm		
Protected Phases	7	4		3	8			2				6	
Permitted Phases			4			2			2	6			
Actuated Green, G (s)	0.8	32.0	32.0	4.4	35.6			20.7	20.7		20.7		
Effective Green, g (s)	0.8	32.0	32.0	4.4	35.6			20.7	20.7		20.7		
Actuated g/C Ratio	0.01	0.44	0.44	0.06	0.49			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		
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0			3.0	3.0		3.0		
Lane Grp Cap (vph)	20	1571	703	108	1730			369	454		335		
v/s Ratio Prot	0.01	0.26		0.03	0.29								
v/s Ratio Perm			0.05					0.18	0.02		0.11		
w/c Ratio	0.45	0.59	0.11	0.46	0.58			0.62	0.05		0.39		
Uniform Delay, d1	35.4	15.1	11.7	32.7	12.9			22.3	18.6		20.6		
Progression Factor	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	3.1	0.5			3.3	0.0		0.8		
Delay (s)	50.7	15.8	11.8	35.8	13.4			25.6	18.7		21.4		
Level of Service	D	B	B	D	B			C	B		C		
Approach Delay (s)		15.6			14.5			23.7			21.4		
Approach LOS		B			B			C			C		
HCM Average Control Delay		16.4											
HCM Volume to Capacity ratio		0.61											
Actuated Cycle Length (s)		72.1						15.0					
Intersection Capacity Utilization		57.8%											
Analysis Period (min)		15											
c Critical Lane Group													

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

HCM Signalized Intersection Capacity Analysis

3: Kaumualii & KCC

12/3/2010



Lane Configurations	↖	↗	↘	↙	↕	↖	↗	↘	↙	↕	↖	↗
Volume (vph)	153	760	94	71	557	140	129	57	49	37	32	57
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	1.00
Fit	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.85	1.00	0.85	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	1800	1583	1614	1583	1790	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	1339	1583	1395	1583	1395	1583
Peak-hour factor, PHF	0.94	0.94	0.94	0.93	0.93	0.93	0.92	0.92	0.57	0.57	0.57	0.57
Adj. Flow (vph)	163	809	100	76	599	151	140	62	53	65	56	100
RTOR Reduction (vph)	0	0	49	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	Perm	Prot	Perm	Perm	Perm	Perm	Perm	Perm	Perm	Perm	Perm
Protected Phases	7	4		3	8		2	2		6	6	
Permitted Phases		4	4		8	2	2	2	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	
Effective Green, g (s)	12.4	27.2	27.2	7.1	21.9	21.9	16.7	16.7		16.7	16.7	
Actuated g/C Ratio	0.19	0.41	0.41	0.11	0.33	0.33	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	
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)	333	1458	652	190	1174	525	339	401		353	401	
v/s Ratio Prot	c0.09	c0.23		0.04	0.17		c0.15	0.01		0.09	0.02	
v/s Ratio Perm			0.03		0.03		0.60	0.03		0.34	0.06	
v/c Ratio	0.49	0.55	0.08	0.40	0.51	0.10	0.60	0.03		0.34	0.06	
Uniform Delay, d1	24.0	14.8	11.8	27.5	17.7	15.2	21.7	18.6		20.2	18.7	
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	1.1	0.5	0.1	1.4	0.4	0.1	2.8	0.0		0.6	0.1	
Delay (s)	25.1	15.2	11.8	28.8	18.1	15.3	24.5	18.6		20.7	18.8	
Level of Service	C	B	B	C	B	B	C	B		C	B	
Approach Delay (s)		16.4			18.6		23.3			19.9		
Approach LOS		B			B		C			B		

HCM Average Control Delay	18.2	HCM Level of Service	B
HCM Volume to Capacity ratio	0.58		
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		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis

3: Kaumualii & KCC

12/3/2010



Lane Configurations	↖	↗	↘	↙	↕	↖	↗	↘	↙	↕	↖	↗
Volume (vph)	59	827	159	34	965	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	1.00
Fit	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.85	1.00	0.85	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	1789	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	957	1583	957	1583
Peak-hour factor, PHF	0.96	0.96	0.96	0.97	0.97	0.97	0.91	0.91	0.61	0.61	0.61	0.61
Adj. Flow (vph)	61	861	166	35	995	70	210	46	59	151	36	105
RTOR Reduction (vph)	0	0	72	0	0	27	0	0	40	0	0	71
Lane Group Flow (vph)	61	861	94	35	995	43	0	256	19	0	187	34
Turn Type	Prot	Perm	Prot	Perm	Perm	Perm	Perm	Perm	Perm	Perm	Perm	Perm
Protected Phases	7	4		3	8		2	2		6	6	
Permitted Phases		4	4		8	2	2	2	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	
Effective Green, g (s)	5.7	35.8	35.8	3.0	33.1	33.1	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	
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)	128	1602	716	67	1481	662	365	506		306	506	
v/s Ratio Prot	c0.03	c0.24		0.02	c0.28		c0.22	0.01		0.20	0.02	
v/s Ratio Perm			0.06		0.03		0.70	0.04		0.61	0.07	
v/c Ratio	0.48	0.54	0.13	0.52	0.67	0.06	0.70	0.04		0.61	0.07	
Uniform Delay, d1	35.3	15.7	12.6	37.3	18.6	13.7	23.6	18.5		22.7	18.7	
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	2.8	0.3	0.1	7.2	1.2	0.0	6.0	0.0		3.6	0.1	
Delay (s)	38.1	16.0	12.7	44.5	19.8	13.8	29.6	18.5		26.3	18.7	
Level of Service	D	B	B	D	B	B	C	B		C	B	
Approach Delay (s)		16.7			20.2		27.5			23.6		
Approach LOS		B			C		C			C		

HCM Average Control Delay	20.0	HCM Level of Service	C
HCM Volume to Capacity ratio	0.72		
Actuated Cycle Length (s)	79.1	Sum of lost time (s)	20.0
Intersection Capacity Utilization	62.0%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

HCM Unsignalized Intersection Capacity Analysis

9: Kaumualii & Nani

12/3/2010



Lane Configurations	↑↑		↔	↑↑	↔	
Volume (veh/h)	841	5	39	767	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)	924	5	41	816	1	111
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage (veh)	1175					
Upstream signal (ft)						
pX, platoon unblocked			0.89	0.89	0.89	
vC, conflicting volume			930	1418	465	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			686	1231	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	99	85	
cM capacity (veh/h)			809	144	760	

Volume Total	616	314	41	408	408	112
Volume Left	0	0	41	0	0	1
Volume Right	0	5	0	0	0	111
cSH	1700	1700	809	1700	1700	727
Volume to Capacity	0.36	0.18	0.05	0.24	0.24	0.15
Queue Length 95th (ft)	0	0	4	0	0	14
Control Delay (s)	0.0	0.0	9.7	0.0	0.0	10.8
Lane LOS			A			B
Approach Delay (s)	0.0		0.5			10.8
Approach LOS						B

Average Delay			0.9			
Intersection Capacity Utilization			42.6%		ICU Level of Service	A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis

9: Kaumualii & Nani

12/3/2010



Lane Configurations	↑↑		↔	↑↑	↔	
Volume (veh/h)	965	8	30	1065	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)	1175					
Upstream signal (ft)						
pX, platoon unblocked			0.88	0.88	0.88	
vC, conflicting volume			1024	1618	512	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			754	1429	171	
tC, single (s)			4.1	6.8	6.9	
tC, 2 stage (s)						
tF (s)			2.2	3.5	3.3	
p0 queue free %			96	98	92	
cM capacity (veh/h)			750	106	741	

Volume Total	677	347	30	538	538	65
Volume Left	0	0	30	0	0	3
Volume Right	0	8	0	0	0	63
cSH	1700	1700	750	1700	1700	600
Volume to Capacity	0.40	0.20	0.04	0.32	0.32	0.11
Queue Length 95th (ft)	0	0	3	0	0	9
Control Delay (s)	0.0	0.0	10.0	0.0	0.0	11.7
Lane LOS			B			B
Approach Delay (s)	0.0		0.3			11.7
Approach LOS						B

Average Delay			0.5			
Intersection Capacity Utilization			39.4%		ICU Level of Service	A
Analysis Period (min)			15			

HCM Signalized Intersection Capacity Analysis  
6: Kaunualii & KCC

12/3/2010



Lane Configurations	↔	↑↑	↑	↔	↑↑	184	67	47	181	89	51	1
Volume (vph)	7	787	141	156	738	184	67	47	181	89	51	1
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	0.95	1.00	1.00	0.95			1.00	1.00		1.00	
Fit	1.00	1.00	0.85	1.00	0.97			1.00	0.85		1.00	
Fit Protected	0.95	1.00	1.00	0.95	1.00			0.97	1.00		0.97	
Satd. Flow (prot)	1770	3539	1583	1770	3433			1810	1583		1804	
Fit Permitted	0.95	1.00	1.00	0.95	1.00			0.72	1.00		0.68	
Satd. Flow (perm)	1770	3539	1583	1770	3433			1335	1583		1263	
Peak-hour factor, PHF	0.91	0.91	0.91	0.88	0.88	0.88	0.71	0.71	0.71	0.58	0.58	0.58
Adj. Flow (vph)	8	865	155	177	839	209	94	66	255	153	88	2
RTOR Reduction (vph)	0	0	66	0	15	0	0	0	188	0	0	0
Lane Group Flow (vph)	8	865	89	177	1033	0	0	160	67	0	243	0
Turn Type	Prot	Perm		Prot	Perm		Perm	Perm	Perm	Perm	Perm	
Protected Phases	7	4		3	8			2	2		6	
Permitted Phases			4			2	2	2		6		
Actuated Green, G (s)	1.0	34.0	34.0	14.5	47.5			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	
Actuated g/C Ratio	0.01	0.39	0.39	0.17	0.55			0.26	0.26		0.26	
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)	21	1394	624	297	1890			353	418		334	
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	0.14	0.60	0.55	0.45	0.16				0.73	
Uniform Delay, d1	42.3	21.0	16.8	33.2	12.5	26.5	24.4				28.9	
Progression Factor	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	0.9	0.2				7.7	
Delay (s)	53.5	21.8	16.9	36.4	12.8	27.5	24.6				36.6	
Level of Service	D	C	B	D	B	C	C				D	
Approach Delay (s)		21.3		16.2		25.7					36.6	
Approach LOS		C		B		C					D	

HCM Average Control Delay	21.1	HCM Level of Service	C
HCM Volume to Capacity ratio	0.65		
Actuated Cycle Length (s)	86.3	Sum of lost time (s)	15.0
Intersection Capacity Utilization	57.2%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis  
6: Kaunualii & KCC

12/3/2010



Lane Configurations	↔	↑↑	↑	↔	↑↑	69	183	29	76	82	28	13
Volume (vph)	9	886	119	48	899	69	183	29	76	82	28	13
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	0.95	1.00	1.00	0.95			1.00	1.00		1.00	
Fit	1.00	1.00	0.85	1.00	0.99			1.00	0.85		0.99	
Fit Protected	0.95	1.00	1.00	0.95	1.00			0.96	1.00		0.97	
Satd. Flow (prot)	1770	3539	1583	1770	3501			1786	1583		1777	
Fit Permitted	0.95	1.00	1.00	0.95	1.00			0.68	1.00		0.61	
Satd. Flow (perm)	1770	3539	1583	1770	3501			1276	1583		1121	
Peak-hour factor, PHF	0.95	0.95	0.95	0.96	0.96	0.96	0.91	0.91	0.91	0.84	0.84	0.84
Adj. Flow (vph)	9	933	125	50	936	72	201	32	84	98	33	15
RTOR Reduction (vph)	0	0	50	0	5	0	0	0	0	0	4	0
Lane Group Flow (vph)	9	933	75	50	1003	0	0	233	24	0	142	0
Turn Type	Prot	Perm		Prot	Perm		Perm	Perm	Perm	Perm	Perm	
Protected Phases	7	4		3	8			2	2		6	
Permitted Phases			4			2	2	2		6		
Actuated Green, G (s)	0.8	32.0	32.0	4.4	35.6			21.1	21.1		21.1	
Effective Green, g (s)	0.8	32.0	32.0	4.4	35.6			21.1	21.1		21.1	
Actuated g/C Ratio	0.01	0.44	0.44	0.06	0.49			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	
Vehicle Extension (s)	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	
v/s Ratio Prot	0.01	0.26		0.03	0.29							
v/s Ratio Perm			0.05					0.18	0.02		0.13	
v/c Ratio	0.45	0.60	0.11	0.47	0.58			0.63	0.05		0.44	
Uniform Delay, d1	35.6	15.4	11.9	32.9	13.2			22.3	18.5		20.9	
Progression Factor	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	0.0		0.9	
Delay (s)	50.9	16.0	11.9	36.1	13.7			25.6	18.6		21.8	
Level of Service	D	B	B	D	B			C	B		C	
Approach Delay (s)		15.8		14.7				23.7			21.8	
Approach LOS		B		B				C			C	

HCM Average Control Delay	16.7	HCM Level of Service	B
HCM Volume to Capacity ratio	0.62		
Actuated Cycle Length (s)	72.5	Sum of lost time (s)	15.0
Intersection Capacity Utilization	57.8%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			





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