## Traffic Impact Report

## Vida at 888 Ala Moana



Prepared for: Kobayashi Group, LLC

Prepared by: Wilson Okamoto Corporation

June 2014

## TRAFFIC IMPACT REPORT

## FOR

## VIDA AT 888 ALA MOANA

Prepared for:

Kobayashi Group, LLC 1288 Ala Moana Blvd., Suite 201 Honolulu, Hawaii 96814

Prepared by:

Wilson Okamoto Corporation 1907 S. Beretania Street, Suite 400 Honolulu, Hawaii 96826 WOC Ref #10058-01

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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 proposed Vida at 888 Ala Moana development (hereinafter referred to as the "Vida development") in Kakaako on the island of Oahu. The project entails the replacement of an existing car dealership with a new multi-use development which will include residential and commercial uses.

## 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

The project site for the Vida development is located adjacent to Ala Moana Boulevard between Koula Street and Ward Avenue in Kakaako on the island of Oahu (see Figure 1). The project site is bounded by Ala Moana Boulevard to the south, Koula Street to the west, Auahi Street to the north, and other commercial uses to the east. Access to the proposed Vida development will be provided via new driveways off Ala Moana Boulevard, Koula Street, and Auahi Street.

## **B. Project Characteristics**

The project site for the Vida development currently houses the Cutter Auto car dealership. The proposed project entails the replacement of the existing



dealership with a multi-use development that is expected to include the following:

- Multi-family residential units (approximately 265 units)
- Commercial uses (approximately 20,000 square feet)
- Recreational amenities and on-site parking

The proposed development is expected to be completed and occupied by the Year 2017. Primary access will be provided via new driveways off Ala Moana Boulevard and Koula Street with access to the proposed loading area provided via a new driveway off Auahi Street. Figure 2 shows the proposed site plan.

## III. BASELINE TRAFFIC CONDITIONS

## A. Area Roadway System

The proposed development will be located adjacent to Ala Moana Boulevard in Kakaako. In the vicinity of the project site, Ala Moana Boulevard is a predominantly six-lane, two-way roadway generally oriented in the east-west direction that serves as a major east-west corridor through Kakaako. West of the project site, Ala Moana Boulevard intersects Cooke Street. At this signalized intersection, both approaches of Ala Moana Boulevard have an exclusive left-turn lane, two through lanes, and a shared through and right-turn lane. Cooke Street is a predominantly four-lane, two-way roadway generally oriented in the north-south direction that serves as a connector road between the east-west corridors in the region. At the intersection with Ala Moana Boulevard, the northbound and southbound approaches of Cooke Street have a shared left-turn and through lane, and an exclusive right-turn lane.

North of the intersection with Ala Moana Boulevard, Cooke Street intersects Auahi Street. At this all-way stop-controlled intersection, the northbound and southbound approaches of Cooke Street have two lanes that serve all traffic movements. In the vicinity of the project site, Auahi Street is a two-lane, two-way roadway generally oriented in the east-west direction. At the intersection with Cooke Street, the eastbound and westbound approaches of Auahi Street have one lane that serves all traffic movements.



East of the intersection with Cooke Street, Ala Moana Boulevard intersects Koula Street. At this signalized intersection, both approaches of Ala Moana Boulevard have an exclusive left-turn lane, two through lanes, and a shared through and right-turn lane. Koula Street is a predominately two-lane, two-way roadway oriented generally in the north-south direction. At the intersection with Ala Moana Boulevard, the northbound and southbound approaches of Koula Street have one lane that serves all traffic movements.

Further east, Ala Moana Boulevard intersects Ahui Street. At this unsignalized T-intersection, the eastbound approach has two through lanes and a shared through and right-turn lane while the westbound approach of Ala Moana Boulevard has three through lanes. Ahui Street is a predominately two-lane, two-way roadway generally oriented in the north-south direction. At the intersection with Ala Moana Boulevard, the northbound approach of Ahui Street has one stop-controlled lane that serves right-turn traffic movements.

## **B.** Traffic Volumes and Conditions

## 1. General

## a. Field Investigation

Field investigations were conducted in April and May 2011, as well as, November 2012 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:

- Ala Moana Boulevard and Cooke Street
- Cooke Street and Auahi Street
- Ala Moana Boulevard and Koula Street
- Ala Moana Boulevard and Ahui Street

Appendix A includes the baseline 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 periods 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. Baseline Peak Hour Traffic

## a. General

Figures 3 and 4 show the baseline AM and PM peak period traffic volumes and operating conditions. The AM peak hour of traffic generally occurs between 7:45 AM and 8:45 AM. The PM peak hour of traffic generally occurs between the hours of 4:15 PM and 5:15 PM. The analysis is based on these peak hour time periods for each intersection to identify the traffic impacts resulting from the proposed project. LOS calculations are included in Appendix C.





## b. Ala Moana Boulevard and Cooke Street

At the intersection with Cooke Street, Ala Moana Boulevard carries 1,884 vehicles eastbound and 1,778 vehicles westbound during the AM peak period. During the PM peak period, the overall traffic volume was higher with 2,232 vehicles traveling eastbound and 1,692 vehicles traveling westbound. The eastbound approach of Ala Moana Boulevard operates at LOS "A" during both peak periods while the westbound approach operates at LOS "B" and LOS "A" during the AM and PM peak periods, respectively.

Cooke Street carries 40 vehicles northbound and 112 vehicles southbound during the AM peak period. During the PM peak period, traffic volumes were higher with 64 vehicles traveling northbound and 195 vehicles traveling southbound. The northbound approach of Cooke Street operates at LOS "C" during both peak periods while the southbound approach operates at LOS "B" during both peak periods.

## c. Cooke Street and Auahi Street

At the intersection with Auahi Street, Cooke Street carries 163 vehicles northbound and 183 vehicles southbound during the AM peak period. During the PM peak period, the overall traffic volume is approximately the same with 133 vehicles traveling northbound and 215 vehicles traveling southbound. Both approaches of Cooke Street both operate at LOS "A" during both peak periods.

Auahi Street carries 56 vehicles eastbound and 28 vehicles westbound at this intersection during the AM peak period. During the PM peak period, traffic volumes were higher with 86 vehicles traveling eastbound and 46 vehicles traveling westbound. Both approaches both operate at LOS "A" during both peak periods.

## d. Ala Moana Boulevard and Koula Street

At the intersection with Koula Street, Ala Moana Boulevard carries 1,775 vehicles eastbound and 1,786 vehicles westbound during

the AM peak period. During the PM peak period, the overall traffic volume was higher with 2,217 vehicles traveling eastbound and 1,712 vehicles traveling westbound. Both approaches of Ala Moana Boulevard operate at LOS "A" during both peak periods.

Koula Street carries 13 vehicles northbound and 16 vehicles southbound during the AM peak period. During the PM peak period, the overall traffic volume is higher with 10 vehicles traveling northbound and 45 vehicles traveling southbound. Both approaches of Koula Street operates at LOS "C" during both peak periods.

## e. Ala Moana Boulevard and Ahui Street

At the intersection with Ahui Street, Ala Moana Boulevard carries 1,753 vehicles eastbound and 1,786 vehicles westbound during the AM peak period. During the PM peak period, the overall traffic volume is higher with 2,211 vehicles traveling eastbound and 1,712 vehicles traveling westbound.

The northbound approach of Ahui Street carries 10 vehicles during the AM peak period and 2 vehicles during the PM peak period. The northbound approach of Ahui Street operates at LOS "A" during both peak periods.

## 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, 9<sup>th</sup> Edition," 2012. 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 dwelling unit or 1,000 square feet of development. It should be noted that although the proposed development is expected to replace an existing car dealership, all site-generated trips were conservatively assumed to be new trips in the project vicinity. The trip generation methodology developed by ITE also includes provisions for internal capture of trips. Internal capture of trips accounts for vehicles that visit more than one destination within the same area without adding external vehicular trips to the surrounding roadways. As such, the proposed peak hour trip generation for the development was adjusted for internal capture of trips. Table 1 summarizes the adjusted project site trip generation characteristics of the proposed project.

HIGH-RISE I	RESIDENTIAL	CONDOMINIUM/TOWNHOUSE
INDEPENDEN	NT VARIABLES	: # of dwelling units = $265$
		PROJECTED TRIP ENDS
AM PEAK	ENTER	20
	EXIT	86
	TOTAL	106
PM PEAK	ENTER	62
	EXIT	38
	TOTAL	100
SPECIALTY	<b>RETAIL CENT</b>	'ER
INDEPENDEN	NT VARIABLE:	1,000 sf of development = $20$
		PROJECTED TRIP ENDS
AM PEAK	ENTER	0
	EXIT	0
	TOTAL	0
PM PEAK	ENTER	22
	EXIT	26
	TOTAL	48
TOTALS		
		PROJECTED TRIP ENDS
AM PEAK	ENTER	20
	EXIT	86
	TOTAL	106
PM PEAK	ENTER	84
	EXIT	64
	TOTAL	148

## 2. Trip Distribution

Figures 5 and 6 show the distribution of site-generated vehicular trips at the study intersections during the Year 2017 peak periods. Primary access to the Vida development will be provided via new driveways off Koula Street and Ala Moana Boulevard. Due to the close proximity of the proposed driveway off Ala Moana Boulevard to the adjacent intersection with Ahui Street and high volume of traffic along Ala Moana Boulevard, the turning movements at that driveway are assumed to be restricted to right-turn-in and right-turn-out traffic movements. The direction distribution of site-generated vehicles was based on the baseline distribution of traffic along Ala Moana Boulevard. As such, 51.0% of trips were assumed to be traveling westbound and 49.0% of trips were assumed to be traveling eastbound during the AM peak period while 43.7% of trips were assumed to be traveling westbound and 56.3% were assumed to be traveling eastbound during the PM peak period. The trips were distributed between the two project driveways and at the study intersections based on their assumed origin/destination, relative convenience of the available routes, and allowed turning movements at the driveways.

## B. Through Traffic Forecasting Methodology

The travel forecast utilized for this study is based on the Oahu Metropolitan Planning Organization (OMPO) regional forecasting model which includes the development of other projects such as the adjacent Ward developments by Howard Hughes Corporation to the east. The use of the OMPO model more accurately reflects the anticipated impacts of traffic growth on the island more than the use of historical traffic count data. The travel forecast utilized for the OMPO model is based on Societal Economic Data (SED) which represents the population distribution within a multitude of traffic analysis zones. As such, since population estimates for the island of Oahu indicate that population growth is expected to be relatively linear to the Year 2035, a linear growth in traffic was also assumed over that period. Consequently, the traffic forecast from the OMPO model was scaled appropriately to determine Year 2017 traffic volumes.





## C. Total Traffic Volumes Without Project

The projected Year 2017 AM and PM peak period traffic volumes and operating conditions without the Vida development are shown in Figures 7 and 8, and summarized in Table 2. The baseline levels of service are provided for comparison purposes. LOS calculations are included in Appendix D.

Intersection	Approach	A	Μ	P	Μ
		Base- line	Year 2017 w/out Proj	Base- line	Year 2017 w/out Proj
Ala Moana Blvd/	Eastbound	А	A	А	A
Cooke St	Westbound	В	В	А	А
	Northbound	D	D	D	D
	Southbound	D	D	D	D
Cooke St/	Eastbound	А	А	А	А
Auahi St	Westbound	А	А	А	А
	Northbound	А	А	А	А
	Southbound	А	А	А	А
Ala Moana Blvd/	Eastbound	А	А	А	А
Koula	Westbound	А	А	А	А
	Northbound	D	D	D	D
	Southbound	D	D	D	D
Ala Moana Blvd/Ahui St	Northbound	А	А	А	А

Table 2: Baseline and Projected Year 2017 (Without Project) LOSTraffic Operating Conditions

Under Year 2017 without project conditions, traffic operations are expected to remain similar to baseline conditions. Along Cooke Street, traffic operations at the intersection with Auahi Street are expected to continue operating at LOS "A" during both peak periods while those at the intersection with Ala Moana Boulevard are expected to continue operating at LOS "D" or better during both peak periods. Along Ala Moana Boulevard, traffic operations at the intersection with Koula Street are expected to continue operating at LOS "D" or better during both peak periods.





the northbound approach of the intersection with Ahui Street is expected to continue operating at LOS "A" during both peak periods.

## D. Total Traffic Volumes With Project

Figures 9 and 10 show the Year 2017 cumulative AM and PM peak hour traffic conditions resulting from the projected external traffic and the proposed Vida development. The cumulative volumes consist of site-generated traffic superimposed over Year 2017 projected traffic demands. The traffic impacts resulting from the proposed project are addressed in the following section.

## V. TRAFFIC IMPACT ANALYSIS

The Year 2017 cumulative AM and PM peak hour traffic conditions with the Vida development are summarized in Table 3. The existing and projected Year 2017 (Without Project) operating conditions are provided for comparison purposes. LOS calculations are included in Appendix E.

Intersection	Approach		AN	1		PM	1
		Base- line	Year 2017 w/out Proj	Year 2017 w/ Proj	Base- line	Year 2017 w/out Proj	Year 2017 w/ Proj
Ala Moana Blvd/	Eastbound	А	A	А	А	A	А
Cooke St	Westbound	В	В	В	А	A	А
	Northbound	D	D	D	D	D	D
	Southbound	D	D	D	D	D	D
Cooke St/	Eastbound	А	А	А	А	A	А
Auahi St	Westbound	А	А	А	А	A	А
	Northbound	А	А	А	А	A	А
	Southbound	А	А	А	А	A	А
Ala Moana Blvd/	Eastbound	А	А	А	А	A	А
Koula St	Westbound	А	А	А	А	A	А
	Northbound	D	D	D	D	D	D
	Southbound	D	D	D	D	D	D
Ala Moana Blvd/ Ahui St	Northbound	А	А	А	А	A	А

 Table 3: Baseline and Projected Year 2017 (Without and With Project) LOS

 Traffic Operating Conditions





Under Year 2017 with project conditions, traffic operations in the project vicinity are generally expected to remain similar to baseline and without project conditions despite the anticipated increases in traffic along the surrounding roadways. Along Cooke Street, at the intersection with Ala Moana Boulevard, traffic operations are expected to continue operating at LOS "D" or better during both peak periods while those at the intersection with Auahi Street are expected to continue operating at LOS "A" during both peak periods. Along Ala Moana Boulevard, traffic operations at the intersection with Koula Street are expected to continue operating at LOS "D" or better during both peak periods while the northbound approach of the intersection with Ahui Street is expected to continue operating at LOS "A" during both peak periods while the northbound approach of the intersection with Ahui Street is expected to continue operating at LOS "A"

## VI. RECOMMENDATIONS

Based on the analysis of the traffic data, the following are the recommendations of this study to be incorporated in the project design.

- 1. Maintain sufficient sight distance for motorists to safely enter and exit all project driveways.
- 2. Provide adequate on-site loading and off-loading service areas and prohibit off-site loading operations.
- 3. Provide adequate turn-around area for service, delivery, and refuse collection vehicles to maneuver on the project site to avoid vehicle-reversing maneuvers onto public roadways.
- 4. Provide sufficient turning radii at all project driveways to avoid or minimize vehicle encroachments to oncoming traffic lanes.
- 5. During the design phase of the project, consider the incorporation of complete streets concepts if possible.
- 6. Restrict turning movements at the project driveway along Ala Moana Boulevard to right-turn-in and right-turn-out movements.
- 7. At the intersection of Auahi Street and Koula Street, provide sufficient turning radii for all approaches of the intersection. Due to the development of the proposed project, traffic along Koula Street is expected to increase. In addition, access to the loading area for the proposed development is expected to be provided via Auahi Street. As such, the turning radii at the adjacent intersection should be assessed during the design phase of the project to ensure that all design vehicles will be able to navigate the intersection.

## VII. CONCLUSION

The proposed Vida development entails the replacement of an existing car dealership with a new multi-use development that will include residential and commercial uses. Traffic in the vicinity of the proposed development is expected to operate at levels of service similar to baseline and without project conditions. As such, with the implementation of the aforementioned recommendations, the proposed Vida development is not expected to have a significant impact on traffic operations in the vicinity.

## APPENDIX A

## BASELINE TRAFFIC COUNT DATA

Counter:D1-0768, D4-3889 Counted By:DY, JH Weather:Clear

File Name : CooAua AM Site Code : 00000001 Start Date : 4/18/2011 Page No : 1

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06:00 AM	-	10	11	2	24	0	0	0	з	e	0	12	2	2	16	-	2	ę	-	7	50
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Total	œ	100	47	80	163	-	15	13	œ	37	26	123	7	5	161	36	12	12	13	73	434
08:00 AM	7	25	23	ы	60	0	~	4	~	9	4	30	-	2	37	11	0	-	0	14	117
08:15 AM	. 4	40	23	0	67	4	<del>.</del>	2	0	7	9	39	2	0	47	<b>б</b>	c	ი	ო	18	139
08:30 AM	ŝ	42	23	0	68	0	2	4	0	0	4	33	9	2	45	9	4	3	2	15	137
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Total	20	144	85	9	255	7	11	19	2	39	17	128	11	9	162	34	10	11	ი	64	520
Grand Total	35	295	159	23	512	0	27	36	17	89	46	328	26	18	418	98	32	30	29	189	1208
Apprch %	6.8	57.6	31.1	4.5		10.1	30.3	40.4	19.1		11	78.5	6.2	4.3		51.9	16.9	15.9	15.3		
Total %	2.9	24.4	13.2	1.9	42.4	0.7	2.2	რ	1.4	7.4	3.8	27.2	2.2	1.5	34.6	8.1	2.6	2.5	2.4	15.6	
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08:45 AM		9	37	16	59		3	4	6	16	e	2	9	2	31	∞	-		4	13	119
Total Volume	0	0	44	85	249		~	11	19	37	17	12,	8	11	156	34	10	-	-	55	497
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HHH	.71	4 .8	121	.924	.915	.436	3.5	50	528	.578	.708	.82	4.	58	.830	.773	.625	.68	80	.917	.914

Counter:D1-0768, D4-3889 Counted By:DY, JH Weather:Clear

File Name : CooAua PM Site Code : 00000001 Start Date : 4/18/2011 Page No : 1

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	Sz		Thru	26	28	33	27	114	PC	20	24	32	106	i	24	21	27	25	97	317	17.1	21.6		Sz
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		i	Start Time	03:00 PM	03:15 PM	03:30 PM	03:45 PM	Total	04:00 PM	04-15 PM	04-30 PM	04:45 PM	Total	100.00	MH 00:00	05:15 PM	05:30 PM	05:45 PM	Total	Grand Total	Apprch %	Total %		

	Int. Total			131	120	121	126	498		QED
	App. Total	and a set of the set		25	17	15	15	27		720
Street	Right			4	2	0	5	10	13.9	625
Auahi S Eastbo	Thru			9	4	5		16	22.2	667
	Left			15	1	80	12	46	63.9	767
	App. Total			36	37	40	34	147		919
street	Right	>		ŝ	~	4	e	13	8.8	650
Cooke	Thru			26	28	33	27	114	77.6	864
	Left			5	8	ę	4	20	13.6	.625
	App. Total			15	20	15	13	63		.788
treet	Right			6	80	9	7	30	47.6	.833
Auahi S Westbo	Thru			e	9	9	ŝ	20	31.7	.833
	Left			e	9	ო	-	13	20.6	.542
	App. Total	1 of 1		55	46	51	64	216		.844
street ound	Right	Peak - Meak	MG 00:	18	7	7	6	41	19	.569
Cooke : Southb	Thru	to 05:45	gins at 03	33	30	40	49	152	70.4	.776
	Left	03:00 PM	section Be	4	6	4	9	23	10.6	.639
	Start Time	ak Hour Analysis From	ak Hour for Entire Inter	03:00 PM	03:15 PM	03:30 PM	03:45 PM	Total Volume	% App. Total	PHF

# Wilson Okamoto Corporation

1907 S. Beretania Street, Suite 400 Honolulu, HI 96826

Counted By: CM, MA Counter: D4-5677, D4-5673 Weather:Clear

File Name : AlaCoo AM Site Code : 0000003 Start Date : 11/7/2012 Page No : 1 Page No

		Int. Total	444	512	706	787	2449	886	964	978	964	3792	930	961	989	906	3786	10027					Int. Total		ORE	000	050	985	3814		.968
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		Left	9	18	19	31	74	16	20	22	25	83	24	23	28	27	102	259	5.1	2.6			Left		26	24	33	28	100	5.3	.893
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## Wilson Okamoto Corporation

1907 S. Beretania Street, Suite 400 Honolulu, Hawaii

Counted By:D4-5673, D4-5677 Counter:CM, MA Weather:Clear

Site Code : 0000003 Start Date : 11/7/2012 Page No : 1 File Name : AlaCoo PM

		Int. Total	924	1049	1012	1089	4074	1019	1075	1054	1089	4237	1030	1016	996	929	3971	12282					Int. Total		1050	1040	1074	1010	4183		07.4
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> Counter:D4--5673, D4-3890 Counted By:AE, JL Weather:Clear

File Name : AlaKou AM : 00000011 : 5/2/2011 ... Site Code Start Date Page No

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> Counter:D4-5673, D4-3890 Counted By:AE, JL Weather:Clear

File Name : AlaKou PM Start Date : 5/2/2011 Page No : 1 Site Code : 0000013

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> Counter:D4-3891, D4-5676 Counted By:PA, BO Weather:Clear

File Name : AlaAhu AM Site Code : 0000008 : 5/2/2011 : 1 Start Date Page No

							Groups	Printed- Ur	nshifted								
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Total	0	2	0	0	0	2	0	0	ო	15	18	0	0	26	0	26	46
07:00 AM	0	0	0	0	0	0	0	0	2	5	7	0	0	10	0	10	17
07:15 AM	0	0	0	0	0	0	0	0	ę	9	6	0	0	18	0	18	27
07:30 AM	0	0	0	0	0	0	0	0	0	2	5	0	0	10	0	10	15
07:45 AM	0	0	0	0	0	0	0	0	S	2	10	0	0	0	0	6	19
Total	0	0	0	0	0	0	0	0	10	21	31	0	0	47	0	47	78
111 00 00	c	c	c	c	c	c	c	c	c	ç	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	C	C	α	C	α	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
U8:00 AM	<b>D</b> 1	0	0	0	0	2 0	0 0	0	0	0 0	<b>7</b> L	0 0	0 0	7 C 7	0 0	7	- 4
08:15 AM	0	0	0	0	0	C	C	C	'n	N	0	5	0	= '	0	= '	2;
08:30 AM	0	0	0	0	0	0	0	0	-	2	n	0	0	0	0		ii.
08:45 AM	0	0	0	0	0	0	0	0	0	-	-	0	0	7	0	1	Ø
Total	0	0	0	0	0	0	0	0	4	ø	12	0	0	34	0	34	46
Grand Total	0	2	0	0	0	2	0	0	17	44	61	0	0	107	0	107	170
Apprch %	8	100	0	0	0		0	0	27.9	72.1		0	0	100	0		
Total %	0	1.2	0	0	0	1.2	0	0	10	25.9	35.9	0	0	62.9	0	62.9	
	S																
			A	Va Moana E	<b>3</b> oulevard				Ahui Stree	ot			Ala M	oana Boule	evard		
	Southbound			Westbo	punc				Northboun	pt			ш I	Eastbound			
Start Time	App. Tota	-	Left	Thru	Right	App. Tota	I Le	Sft .	Thru	Right	App. Total	Left	ЧŢ	5	Right	App. Total	Int. Total
Peak Hour Analysis From	n 06:00 AM to C	38:45 AM	- Peak 1 c	of 1													
		10		c	C	)	10	c	c	0	0	C		C	10	10	12
02.10 MM			0 0	0 0						1 07	1 (7)	00		0	18	18	21
NN 02-20			0 0	0 0					0 0	C	0	0		0	10	10	10
07:45 AM		0.0	0	00	0			00	00	Ω.	2	0		0	0	0	14
Total Volume		-	c	C	0		0	0	0	10	10	0		0	47	47	22
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> Counter:D4-3891, D4-5676 Counted By:PA, BO Weather:Clear

File Name: AlaAhu PM : 00000008 : 5/2/2011 : 1 Site Code Start Date Page No

Groups Printed- Unshifted

					Ahui Street				Ala M	bana Bouleva	ard		
	Southbound	Westbound			Northbound					astbound	-	A T-L-I	Int Total
Start Time	Ann Total	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. 1 otal	Int. Lotal
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				C	0	7	16	0	0	e	0	S	19
MJ 04:00					16	AA.	205	C	c		0	11	61
I OTAI	0	5	D	D	2	5	8	2					
F	c	c	c	C	21	74	95	0	0	38	0	38	133
Grand Iola	D	C			20.1	77 9		0	0	100	0		
Appren %	c	c			15.8	55.6	71.4	0	0	28.6	0	28.6	
10(31 %)	5	>	D	>	2			(					
					Ahui St	reet			Ala I	Joana Boule	vard		
	Southbout	nd Westbo	pund		Northdo	pung				Edstavuniu		ALL Tabel	Int Total
Start Til	me App.	Total Ap	p. Total	Left	Thru	Right	App. Total	Let	_	nu	Kight	App. 1 0tal	1111. 1 0141
Peak Hour Analysis From C	03:00 PM to 05:45	5 PM - Peak 1 of	-										
Peak Hour for Entire Interst	ection Begins at 0	05:00 PM				3				c	×	*	Ľ
02:00	Wo	0	0	0	0	4	4		-	5	- 0	- (	
05-151	Ma	0	0	0	0	2	2		-	C	N	11	1 (
05-301	Mo	C	0	0	0	-	-		_	0	C)	0	0
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02-000	M. M.		c	C	C	16	16		-	0	11	1	27
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## **APPENDIX B**

## LEVEL OF SERVICE DEFINITIONS

## LEVEL OF SERVICE DEFINITIONS

### LEVEL-OF-SERVICE CRITERIA FOR MULTILANE HIGHWAY

A multilane highway is characterized by three performance measures:

- Density, in terms of passenger cars per mile per lane
- Speed, in terms of mean passenger car speed; and
- Volume to capacity ratio

Each of these measures indicates how well the highway accommodates traffic flow.

Density is the assigned primary performance measure for estimating the level-of-service. The three measures of speed, density, and flow or volume are interrelated. If the values of two of these measures are known, the remaining measure can be computed.

**Level of Service A** describes completely free-flow conditions. The operation of vehicles is virtually unaffected by the presence of other vehicles, and operations are constrained only by the geometric features of the highway and by driver preferences. Maneuverability within the traffic stream is good. Minor disruptions to flow are easily absorbed without a change in travel speed.

**Level of Service B** also indicates free flow, although the presence of other vehicles becomes noticeable. Average travel speeds are the same as in LOS A, but drivers have slightly less freedom to maneuver. Minor disruptions are still easily absorbed, although local deterioration in LOS will be more obvious.

In **Level of Service C**, the influence of traffic density on operations become marked. The ability to maneuver within the traffic stream is now clearly affected by other vehicles. On multilane highways with a free-flow speed above 50 mi/h, the travel speeds reduce somewhat. Minor disruptions can cause serious local deterioration in service, and queues will form behind any significant traffic disruption.

At **Level of Service D**, the ability to maneuver is severely restricted due to traffic congestion. Travel speed is reduced by increasing volume. Only minor disruptions can be absorbed without extensive queues forming and the service deteriorating.

**Level of Service E** represents operations at or near capacity, an unstable level. The densities vary depending on the free-flow speed. Vehicles are operating with the minimum spacing for maintaining uniform flow. Disruptions cannot be dissipated readily, often causing queues to form and service to deteriorate to LOS F. For the majority of multilane highways with free-flow speeds between 45 and 60 mi/h, passenger-car mean speeds at capacity range from 42 to 55 mi/h but are highly variable and unpredictable.

**Level of Service F** represents forced or breakdown flow. It occurs either when vehicles arrive at a rate greater than the rate at which they are discharged or when the forecast demand exceeds the computed capacity of a planned facility. Although operations at these points--and on sections immediately downstream--appear to be at capacity, queues form behind these breakdowns. Operations within queues are highly unstable, with vehicles experiencing brief periods of movement followed by stoppages. Travel speeds within queues are generally less than 30 mi/h. Note that the term LOS F may be used to characterize both the point of the breakdown and the operating condition within the queue.

## **APPENDIX C**

## CAPACITY ANALYSIS CALCULATIONS BASELINE PEAK PERIOD TRAFFIC ANALYSIS

## HCM Signalized Intersection Capacity Analysis 5: Ala Moana Blvd & Cooke St

	۶	-	$\mathbf{r}$	1	-	A.	1	Ť	r	1	¥	1
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	ň	<b>ተ</b> ተጮ		ሻ	<b>11</b>			÷.	7		ર્લ	1
Volume (vph)	100	1740	44	11	1730	37	19	14	7	28	21	63
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0			5.0	5.0		5.0	5.0
Lane Util. Factor	1.00	0.91		1.00	0.91			1.00	1.00		1.00	1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00			1.00	0.98		1.00	0.98
Flpb, ped/bikes	1.00	1.00		1.00	1.00			1.00	1.00		1.00	1.00
Frt	1.00	1.00		1.00	1.00			1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00			0.97	1.00		0.97	1.00
Satd. Flow (prot)	1770	5062		1770	5066			1804	1551		1806	1544
Flt Permitted	0.95	1.00		0.95	1.00			0.79	1.00		0.80	1.00
Satd. Flow (perm)	1770	5062		1770	5066	1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1		1467	1551	131.30	1495	1544
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	103	1794	45	11	1784	38	20	14	7	29	22	65
RTOR Reduction (vph)	0	1	0	0	2	0	0	0	6	0	0	60
Lane Group Flow (vph)	103	1838	0	11	1820	0	0	34	1	0	51	5
Confl. Peds. (#/hr)			8			12	5		8	5		12
Turn Type	Prot			Prot			Perm		Perm	Perm		Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases							8		8	4		4
Actuated Green, G (s)	11.0	62.4		1.0	52.4			7.0	7.0		7.0	7.0
Effective Green, g (s)	11.0	62.4		1.0	52.4			7.0	7.0		7.0	7.0
Actuated g/C Ratio	0.13	0.73		0.01	0.61			0.08	0.08		0.08	0.08
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)	228	3699		21	3108			120	127		123	127
v/s Ratio Prot	c0.06	c0.36		0.01	c0.36							
v/s Ratio Perm								0.02	0.00		c0.03	0.00
v/c Ratio	0.45	0.50		0.52	0.59			0.28	0.00		0.41	0.04
Uniform Delay, d1	34.4	4.9		42.0	10.0			36.8	36.0		37.3	36.1
Progression Factor	1.00	1.00		1.00	1.00			1.00	1.00		1.00	1.00
Incremental Delay, d2	1.4	0.1		21.6	0.3			1.3	0.0		2.3	0.1
Delay (s)	35.8	5.0		63.5	10.2			38.1	36.0		39.5	36.2
Level of Service	D	А		E	В			D	D		D	D
Approach Delay (s)		6.6			10.6			37.8			37.7	
Approach LOS		А			В			D			D	
Intersection Summary												
HCM Average Control Dela	ay		9.7	Н	CM Level	of Servic	е		А			
HCM Volume to Capacity r	atio		0.59									
Actuated Cycle Length (s)			85.4	S	um of lost	time (s)			20.0			
Intersection Capacity Utilization	ation		65.2%	IC	CU Level o	of Service			С			
Analysis Period (min)			15									

## HCM Signalized Intersection Capacity Analysis 8: Ala Moana Blvd & Koula St

	٨	-	>	1	-	×.	1	Ť	p	1	Ļ	~
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	ή	<b>11</b>		ሻ	<b>ተተ</b> ጮ			4			\$	
Volume (vph)	18	1742	15	6	1771	9	5	4	4	7	7	2
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	
Lane Util. Factor	1.00	0.91		1.00	0.91			1.00			1.00	
Frpb, ped/bikes	1.00	1.00		1.00	1.00			0.99			1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00			1.00			0.99	
Frt	1.00	1.00		1.00	1.00			0.96			0.98	
Flt Protected	0.95	1.00		0.95	1.00			0.98			0.98	
Satd. Flow (prot)	1770	5077		1770	5080			1736			1772	
Flt Permitted	0.95	1.00		0.95	1.00			1.00			1.00	
Satd. Flow (perm)	1770	5077		1770	5080	1.1		1770		P. B. S. S.	1810	
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	19	1796	15	6	1826	9	5	4	4	7	7	2
RTOR Reduction (vph)	0	0	0	0	0	0	0	4	0	0	2	0
Lane Group Flow (vph)	19	1811	0	6	1835	0	0	9	0	0	14	0
Confl. Peds. (#/hr)			17			26			20	20		26
Turn Type	Prot	1.17%	10.23	Prot		No field	Perm			Perm		
Protected Phases	5	2		1	6			8			4	
Permitted Phases							8			4		
Actuated Green, G (s)	2.2	50.7		0.8	49.3			1.1			1.1	
Effective Green, g (s)	2.2	50.7		0.8	49.3			1.1			1.1	
Actuated g/C Ratio	0.03	0.75		0.01	0.73			0.02			0.02	
Clearance Time (s)	5.0	5.0		5.0	5.0			5.0			5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0			3.0	
Lane Grp Cap (vph)	58	3808		21	3705		4.4.4	29			29	
v/s Ratio Prot	c0.01	0.36		0.00	c0.36							
v/s Ratio Perm								0.01			c0.01	
v/c Ratio	0.33	0.48		0.29	0.50			0.31			0.48	
Uniform Delay, d1	32.0	3.3		33.1	3.9			32.9			33.0	
Progression Factor	1.00	1.00		1.00	1.00			1.00			1.00	
Incremental Delay, d2	3.3	0.1		7.4	0.1			6.1			12.2	
Delay (s)	35.3	3.4		40.5	4.0			39.0			45.1	
Level of Service	D	А		D	А			D			D	
Approach Delay (s)		3.7			4.1			39.0			45.1	
Approach LOS		А			А			D			D	
Intersection Summary												
HCM Average Control Dela	iy		4.2	H	ICM Level	of Servic	e		А			
HCM Volume to Capacity ra	atio		0.49									
Actuated Cycle Length (s)			67.6	S	um of lost	t time (s)			15.0			
Intersection Capacity Utiliza	ation		55.8%	10	CU Level of	of Service	l.		В			
Analysis Period (min)			15									

		$\mathbf{r}$	-		1	M				
Movement	EBT	EBR	WBL	WBT	NBL	NBR				
Lane Configurations	<b>443</b>			***		1				
Volume (veh/h)	1706	47	0	1786	0	10				
Sian Control	Free			Free	Stop					
Grade	0%			0%	0%					
Peak Hour Factor	0.95	0.65	0.25	0.87	0.25	0.50				
Hourly flow rate (vph)	1796	72	0	2053	0	20				
Pedestrians				21	21					
Lane Width (ft)				12.0	12.0					
Walking Speed (ft/s)				4.0	4.0					
Percent Blockage				2	2					
Right turn flare (veh)										
Median type	None			None						
Median storage veh)										
Upstream signal (ft)	431									
pX, platoon unblocked			0.86		0.86	0.86				
vC. conflicting volume			1889		2537	677				
vC1. stage 1 conf vol										
vC2, stage 2 conf vol										
vCu, unblocked vol			1470		2223	64				
tC, single (s)			4.1		6.8	*5.9				
tC, 2 stage (s)										
tF (s)			2.2		3.5	3.3				
p0 queue free %			100		100	98				
cM capacity (veh/h)			385		31	837				
Direction Lane #	FB 1	FB 2	FB 3	WB 1	WB 2	WB 3	NB 1			
Volume Total	718	718	431	684	684	684	20			
Volume Left	0	0	0	0	0	0	0			
Volume Right	0	0	72	0	0	0	20			
cSH	1700	1700	1700	1700	1700	1700	837			
Volume to Capacity	0.42	0.42	0.25	0.40	0.40	0.40	0.02			
Queue Length 95th (ft)	0	0	0	0	0	0	2			
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	9.4			
Lane LOS	0.0	0.0					А			
Approach Delay (s)	0.0			0.0			9.4			
Approach LOS							А			
Intersection Summary										
Average Delay	A STATE OF A STATE		0.0							
Intersection Capacity Utilizati	ion		49.5%	10	CU Level	of Service		,	A	
Analysis Period (min)			15							

\* User Entered Value

## HCM Unsignalized Intersection Capacity Analysis 17: Auahi St & Cooke St

	≯	-	$\mathbf{i}$	1	+	A.	1	Ť	r	1	ţ	1
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		4			4			đ î b			4î î>	
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	36	11	9	1	13	14	27	132	4	15	105	63
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	40	12	10	1	14	16	30	147	4	17	117	70
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2						
Volume Total (vph)	62	31	103	78	75	128						
Volume Left (vph)	40	1	30	0	17	0						
Volume Right (vph)	10	16	0	4	0	70						
Hadj (s)	0.07	-0.26	0.18	-0.01	0.15	-0.35						
Departure Headway (s)	4.9	4.6	5.1	4.9	5.0	4.5						
Degree Utilization, x	0.08	0.04	0.15	0.11	0.11	0.16						
Capacity (veh/h)	685	719	688	712	690	768						
Control Delay (s)	8.3	7.8	7.8	7.3	7.4	7.2						
Approach Delay (s)	8.3	7.8	7.5		7.3							
Approach LOS	А	А	А		А							
Intersection Summary									S. Salar			
Delay			7.6									
HCM Level of Service			А									
Intersection Capacity Utilization			34.9%	IC	U Level o	of Service			А			
Analysis Period (min)			15									

## HCM Signalized Intersection Capacity Analysis 5: Ala Moana Blvd & Cooke St

	٨	-	>	1	-	*	1	Ť	1	1	¥	1
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	ĥ	<b></b>		ሻ	<u> </u>			é	7		éî.	1
Volume (vph)	57	2159	16	4	1649	39	26	31	7	51	20	124
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0			5.0	5.0		5.0	5.0
Lane Util. Factor	1.00	0.91		1.00	0.91			1.00	1.00		1.00	1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00			1.00	0.96		1.00	0.97
Flpb, ped/bikes	1.00	1.00		1.00	1.00			1.00	1.00		0.99	1.00
Frt	1.00	1.00		1.00	1.00			1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00			0.98	1.00		0.97	1.00
Satd. Flow (prot)	1770	5077		1770	5063			1818	1522		1777	1530
Flt Permitted	0.95	1.00		0.95	1.00			0.83	1.00		0.75	1.00
Satd. Flow (perm)	1770	5077		1770	5063			1538	1522		1381	1530
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	59	2226	16	4	1700	40	27	32	7	53	21	128
RTOR Reduction (vph)	0	1	0	0	2	0	0	0	6	0	0	91
Lane Group Flow (vph)	59	2241	0	4	1738	0	0	59	1	0	74	37
Confl. Peds. (#/hr)			25			20	4		25	16		20
Turn Type	Prot			Prot	- 1 - M	154.00	Perm		Perm	Perm		Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases							8		8	4		4
Actuated Green, G (s)	7.3	61.8		0.5	55.0			10.8	10.8		10.8	10.8
Effective Green, g (s)	7.3	61.8		0.5	55.0			10.8	10.8		10.8	10.8
Actuated g/C Ratio	0.08	0.70		0.01	0.62			0.12	0.12		0.12	0.12
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)	147	3561		10	3161		Che Carl	189	187		169	188
v/s Ratio Prot	c0.03	c0.44		0.00	0.34							
v/s Ratio Perm								0.04	0.00		c0.05	0.02
v/c Ratio	0.40	0.63		0.40	0.55			0.31	0.00		0.44	0.20
Uniform Delay, d1	38.3	7.0		43.7	9.5			35.3	33.9		35.8	34.7
Progression Factor	1.00	1.00		1.00	1.00			1.00	1.00		1.00	1.00
Incremental Delay, d2	1.8	0.4		24.2	0.2			0.9	0.0		1.8	0.5
Delay (s)	40.1	7.4		67.9	9.7			36.2	33.9		37.6	35.3
Level of Service	D	А		E	А			D	С		D	D
Approach Delay (s)		8.2			9.8			36.0			36.1	
Approach LOS		А			А			D			D	
Intersection Summary												
HCM Average Control Dela	ау		10.6	Н	CM Level	of Servic	e		В			
HCM Volume to Capacity r	ratio		0.61						1978 - 19			
Actuated Cycle Length (s)			88.1	S	um of losi	t time (s)			15.0			
Intersection Capacity Utiliz	ation		79.1%	IC	CU Level of	of Service			D			
Analysis Period (min)			15									

## HCM Signalized Intersection Capacity Analysis 8: Ala Moana Blvd & Koula St

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Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	ή	<b>1</b>		ή	<b>ተተ</b> ጮ			<b>\$</b>			<b>\$</b>	
Volume (vph)	18	2189	10	7	1669	36	1	6	3	22	1	22
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0			5.0			5.0	
Lane Util. Factor	1.00	0.91		1.00	0.91			1.00			1.00	
Frpb, ped/bikes	1.00	1.00		1.00	1.00			0.99			0.98	
Flpb, ped/bikes	1.00	1.00		1.00	1.00			1.00			0.99	
Frt	1.00	1.00		1.00	1.00			0.96			0.93	
Flt Protected	0.95	1.00		0.95	1.00			1.00			0.98	
Satd. Flow (prot)	1770	5080		1770	5059			1761			1652	
Flt Permitted	0.95	1.00		0.95	1.00			0.96			0.84	
Satd. Flow (perm)	1770	5080		1770	5059		91 - Paul	1699		10.25	1421	
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	19	2257	10	7	1721	37	1	6	3	23	1	23
RTOR Reduction (vph)	0	0	0	0	1	0	0	3	0	0	21	0
Lane Group Flow (vph)	19	2267	0	7	1757	0	0	7	0	0	26	0
Confl. Peds. (#/hr)			20			28			20	13		28
Turn Type	Prot			Prot			Perm			Perm		
Protected Phases	5	2		1	6			8			4	
Permitted Phases							8			4		
Actuated Green, G (s)	2.4	66.3		0.7	64.6			5.9			5.9	
Effective Green, g (s)	2.4	66.3		0.7	64.6			5.9			5.9	
Actuated g/C Ratio	0.03	0.75		0.01	0.73			0.07			0.07	
Clearance Time (s)	5.0	5.0		5.0	5.0			5.0			5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0			3.0	
Lane Grp Cap (vph)	48	3832		14	3718			114			95	
v/s Ratio Prot	c0.01	c0.45		0.00	0.35							
v/s Ratio Perm								0.00			c0.02	
v/c Ratio	0.40	0.59		0.50	0.47			0.06			0.27	
Uniform Delay, d1	42.0	4.8		43.4	4.7			38.4			39.0	
Progression Factor	1.00	1.00		1.00	1.00			1.00			1.00	
Incremental Delay, d2	5.3	0.2		25.4	0.1			0.2			1.5	
Delay (s)	47.3	5.0		68.8	4.8			38.6			40.5	
Level of Service	D	А		E	А			D			D	
Approach Delay (s)		5.4			5.1			38.6			40.5	
Approach LOS		А			А			D			D	
Intersection Summary												
HCM Average Control Dela	у		5.7	Н	ICM Level	of Servic	e		А			
HCM Volume to Capacity ra	atio		0.54									
Actuated Cycle Length (s)			87.9	S	um of los	t time (s)			10.0			
Intersection Capacity Utilization	ition		66.8%	IC	CU Level of	of Service	n		С			
Analysis Period (min)			15									

	-	$\mathbf{r}$	-	-	1	M			
Movement	EBT	EBR	WBL	WBT	NBL	NBR			
Lane Configurations	<u>ቀ</u> ቀሴ			***		1			
Volume (veh/h)	2200	11	0	1712	0	2			
Sign Control	Free			Free	Stop				
Grade	0%			0%	0%				
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97			
Hourly flow rate (vph)	2268	11	0	1765	0	2			
Pedestrians				12	12				
Lane Width (ft)				12.0	12.0				
Walking Speed (ft/s)				4.0	4.0				
Percent Blockage				1	1				
Right turn flare (veh)									
Median type	None			None					
Median storage veh)									
Upstream signal (ft)	440								
pX. platoon unblocked			0.79		0.79	0.79			
vC, conflicting volume			2291		2874	786			
vC1, stage 1 conf vol									
vC2, stage 2 conf vol									
vCu, unblocked vol			1691		2432	0			
tC. single (s)			4.1		6.8	*5.9			
tC. 2 stage (s)									
tF (s)			2.2		3.5	3.3			
p0 queue free %			100		100	100			
cM capacity (veh/h)			291		21	836			
Direction Lane #	FR 1	FR 2	FR 3	W/R 1	WR 2	WR 3	NR 1	A CALORINA DA LA CALORIZA DA LA CALO	NEW YORK
Volume Total	907	907	465	588	588	588	2	Contraction of the second	Contraction of the
Volume Left	0	0	0	000	000	000	0		
Volume Right	0	0	11	0	0	0	2		
cSH	1700	1700	1700	1700	1700	1700	836		
Volume to Capacity	0.53	0.53	0.27	0.35	0.35	0.35	0.00		
Queue Length 95th (ft)	0	0	0	0	0	0	0		
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	93		
Lane LOS	0.0	010	0.0	0.0	0.0	010	A		
Approach Delay (s)	0.0			0.0			9.3		
Approach LOS							A		
Intersection Summary									
Average Delay			0.0						
Intersection Capacity Utiliz	zation		56.1%	10	CU Level	of Service		В	
Analysis Period (min)			15						

\* User Entered Value

## HCM Unsignalized Intersection Capacity Analysis 17: Auahi St & Cooke St

٨		~	1	-	~	•	Ť	-	1	Ţ	1
EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
	\$			¢.			đ î î î			đ î b	
	Stop			Stop			Stop			Stop	
61	14	11	10	14	22	19	106	8	12	179	24
0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
64	15	11	10	15	23	20	110	8	12	186	25
EB1	WB 1	NB 1	NB 2	SB 1	SB 2						
90	48	75	64	106	118						
64	10	20	0	13	0						
11	23	0	8	0	25						
0.10	-0.21	0.17	-0.06	0.09	-0.11						
4.9	4.6	5.2	5.0	5.1	4.9						
0.12	0.06	0.11	0.09	0.15	0.16						
684	712	662	690	682	713						
8.6	8.0	7.7	7.3	7.8	7.6						
8.6	8.0	7.5		7.7							
А	А	А		А							
											a the second
		7.8	1. mg								
		А									
		36.7%	IC	U Level o	of Service			А			
		15									
	EBL 61 0.96 64 EB 1 90 64 11 0.10 4.9 0.12 684 8.6 8.6 A	<ul> <li>EBL EBT</li> <li>Stop</li> <li>61</li> <li>14</li> <li>0.96</li> <li>0.96</li> <li>64</li> <li>15</li> <li>EB1</li> <li>WB1</li> <li>90</li> <li>48</li> <li>64</li> <li>10</li> <li>11</li> <li>23</li> <li>0.10</li> <li>-0.21</li> <li>4.9</li> <li>4.6</li> <li>0.12</li> <li>0.06</li> <li>684</li> <li>712</li> <li>8.6</li> <li>8.0</li> <li>8.6</li> <li>8.0</li> <li>A</li> <li>A</li> </ul>	EBL       EBT       EBR         Stop	EBL       EBT       EBR       WBL         Stop       11       10         0.96       0.96       0.96       0.96         61       14       11       10         0.96       0.96       0.96       0.96         64       15       11       10         EB1       WB1       NB1       NB2         90       48       75       64         64       10       20       0         11       23       0       8         0.10       -0.21       0.17       -0.06         4.9       4.6       5.2       5.0         0.12       0.06       0.11       0.09         684       712       662       690         8.6       8.0       7.5       A         A       A       A       A         7.8       A       A       A         36.7%       IC       15	EBL       EBT       EBR       WBL       WBT         Stop       Stop       Stop         61       14       11       10       14         0.96       0.96       0.96       0.96       0.96         64       15       11       10       15         EB1       WB1       NB1       NB2       SB1         90       48       75       64       106         64       10       20       0       13         90       48       75       64       106         64       10       20       0       13         11       23       0       8       0         0.10       -0.21       0.17       -0.06       0.09         4.9       4.6       5.2       5.0       5.1         0.12       0.06       0.11       0.09       0.15         684       712       662       690       682         8.6       8.0       7.7       7.3       7.8         8.6       8.0       7.5       7.7       A         A       A       A       A       A         A       A       <	EBL       EBT       EBR       WBL       WBT       WBR         Stop       Stop       Stop       5         61       14       11       10       14       22         0.96       0.96       0.96       0.96       0.96       0.96         64       15       11       10       14       22         90       48       75       64       106       118         64       10       20       0       13       0         90       48       75       64       106       118         64       10       20       0       13       0         11       23       0       8       0       25         0.10       -0.21       0.17       -0.06       0.09       -0.11         4.9       4.6       5.2       5.0       5.1       4.9         0.12       0.06       0.11       0.09       0.15       0.16         684       712       662       690       682       713         8.6       8.0       7.5       7.7       A       A         A       A       A       A       A	EBL       EBT       EBR       WBL       WBT       WBR       NBL         Stop       Stop       Stop       Stop       1       14       11       10       14       22       19         0.96       0.96       0.96       0.96       0.96       0.96       0.96       0.96       0.96         64       15       11       10       15       23       20         EB1       WB1       NB1       NB2       SB1       SB2         90       48       75       64       106       118         64       10       20       0       13       0         11       23       0       8       0       25       0.10         0.10       -0.21       0.17       -0.06       0.09       -0.11         4.9       4.6       5.2       5.0       5.1       4.9         0.12       0.06       0.11       0.09       0.15       0.16         684       712       662       690       682       713         8.6       8.0       7.5       7.7       7.4       A         A       A       A       A       A       4	EBL       EBT       EBR       WBL       WBT       WBR       NBL       NBT         Image: Stop       Stop       Stop       Stop       Stop       Stop         61       14       11       10       14       22       19       106         0.96       0.96       0.96       0.96       0.96       0.96       0.96       0.96       0.96         64       15       11       10       15       23       20       110         EB1       WB1       NB1       NB2       SB1       SB2       SB1         90       48       75       64       106       118       111       10       15       23       20       110         EB1       WB1       NB1       NB2       SB1       SB2       SB2       SB1       SB2         90       48       75       64       106       118       111       10       15       11       10       11	EBL       EBT       EBR       WBL       WBT       WBR       NBL       NBT       NBR         \$	EBL       EBT       EBR       WBL       WBT       WBR       NBL       NBT       NBR       SBL         G1       14       11       10       14       22       19       106       8       12         0.96 <td>EBL       EBT       EBR       WBL       WBT       WBR       NBL       NBT       NBR       SBL       SBT         \$\$\phi\$       \$\$\$\phi\$       \$\$\$\$\$\$\$\$\$\$\$\$\$       \$</td>	EBL       EBT       EBR       WBL       WBT       WBR       NBL       NBT       NBR       SBL       SBT         \$\$\phi\$       \$\$\$\phi\$       \$\$\$\$\$\$\$\$\$\$\$\$\$       \$

## APPENDIX D

## CAPACITY ANALYSIS CALCULATIONS PROJECTED YEAR 2017 PEAK PERIOD TRAFFIC ANALYSIS WITHOUT PROJECT

## HCM Signalized Intersection Capacity Analysis 5: Ala Moana Blvd & Cooke St

	۶	-	$\mathbf{r}$	1	4	×.	1	Ť	r	1	Ļ	1
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	ή	44¢		ሻ	<b>ተ</b> ቶጮ			÷Î	7		<del>د</del> آ	7
Volume (vph)	100	1871	44	11	1860	37	19	14	7	28	21	63
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0			5.0	5.0		5.0	5.0
Lane Util. Factor	1.00	0.91		1.00	0.91			1.00	1.00		1.00	1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00			1.00	0.97		1.00	0.97
Flpb, ped/bikes	1.00	1.00		1.00	1.00			1.00	1.00		1.00	1.00
Frt	1.00	1.00		1.00	1.00			1.00	0.85		1.00	0.85
FIt Protected	0.95	1.00		0.95	1.00			0.97	1.00		0.97	1.00
Satd. Flow (prot)	1770	5063		1770	5067			1804	1543		1803	1543
Flt Permitted	0.95	1.00		0.95	1.00			0.79	1.00		0.80	1.00
Satd. Flow (perm)	1770	5063		1770	5067	STEP 1		1467	1543		1492	1543
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	103	1929	45	11	1918	38	20	14	7	29	22	65
RTOR Reduction (vph)	0	1	0	0	1	0	0	0	6	0	0	60
Lane Group Flow (vph)	103	1973	0	11	1955	0	0	34	1	0	51	5
Confl. Peds. (#/hr)			8			12	5		8	5		12
Turn Type	Prot			Prot			Perm		Perm	Perm		Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases							8		8	4		4
Actuated Green, G (s)	11.4	69.5		1.1	59.2			7.3	7.3		7.3	7.3
Effective Green, g (s)	11.4	69.5		1.1	59.2			7.3	7.3		7.3	7.3
Actuated g/C Ratio	0.12	0.75		0.01	0.64			0.08	0.08		0.08	0.08
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)	217	3788		21	3229			115	121		117	121
v/s Ratio Prot	c0.06	c0.39		0.01	c0.39							
v/s Ratio Perm								0.02	0.00		c0.03	0.00
v/c Ratio	0.47	0.52		0.52	0.61			0.30	0.00		0.44	0.04
Uniform Delay, d1	38.0	4.8		45.6	10.0			40.4	39.5		40.8	39.6
Progression Factor	1.00	1.00		1.00	1.00			1.00	1.00		1.00	1.00
Incremental Delay, d2	1.6	0.1		21.6	0.3			1.4	0.0		2.6	0.1
Delay (s)	39.6	5.0		67.2	10.3			41.8	39.5		43.4	39.7
Level of Service	D	А		E	В			D	D		D	D
Approach Delay (s)		6.7			10.6			41.4			41.3	
Approach LOS		А			В			D			D	
Intersection Summary												
HCM Average Control Dela	ау		9.8	Н	ICM Level	of Service	Э		A			
HCM Volume to Capacity ra	atio		0.61									
Actuated Cycle Length (s)			92.9	S	um of lost	time (s)			20.0			
Intersection Capacity Utiliza	ation		67.7%	10	CU Level o	of Service			С			
Analysis Period (min)			15									

## HCM Signalized Intersection Capacity Analysis 8: Ala Moana Blvd & Koula St

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Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	ካ	<b>ተ</b> ተጮ		ሻ	<b>^</b>			4			4	
Volume (vph)	18	1873	15	6	1904	9	5	4	4	7	7	2
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	
Lane Util. Factor	1.00	0.91		1.00	0.91			1.00			1.00	
Frpb, ped/bikes	1.00	1.00		1.00	1.00			0.99			1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00			1.00			0.99	
Frt	1.00	1.00		1.00	1.00			0.96			0.98	
Flt Protected	0.95	1.00		0.95	1.00			0.98			0.98	
Satd. Flow (prot)	1770	5077		1770	5080			1735			1770	
Flt Permitted	0.95	1.00		0.95	1.00			1.00			1.00	
Satd. Flow (perm)	1770	5077		1770	5080			1769			1809	
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	19	1931	15	6	1963	9	5	4	4	7	7	2
RTOR Reduction (vph)	0	0	0	0	0	0	0	4	0	0	2	0
Lane Group Flow (vph)	19	1946	0	6	1972	0	0	9	0	0	14	0
Confl. Peds. (#/hr)			17			26			20	20		26
Turn Type	Prot			Prot			Perm			Perm		
Protected Phases	5	2		1	6			8			4	
Permitted Phases							8			4		
Actuated Green, G (s)	2.2	56.0		0.8	54.6			2.2			2.2	
Effective Green, g (s)	2.2	56.0		0.8	54.6			2.2			2.2	
Actuated g/C Ratio	0.03	0.76		0.01	0.74			0.03			0.03	
Clearance Time (s)	5.0	5.0		5.0	5.0			5.0			5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0			3.0	
Lane Grp Cap (vph)	53	3842	1. 8. 3	19	3748			53			54	
v/s Ratio Prot	c0.01	0.38		0.00	c0.39							
v/s Ratio Perm								0.01			c0.01	
v/c Ratio	0.36	0.51		0.32	0.53			0.17			0.26	
Uniform Delay, d1	35.2	3.5		36.3	4.2			35.0			35.1	
Progression Factor	1.00	1.00		1.00	1.00			1.00			1.00	
Incremental Delay, d2	4.1	0.1		9.3	0.1			1.5			2.6	
Delay (s)	39.3	3.7		45.7	4.3			36.6			37.7	
Level of Service	D	А		D	А			D			D	
Approach Delay (s)		4.0			4.4			36.6			37.7	
Approach LOS		А			А			D			D	
Intersection Summary					0144	10		(Carls In the				
HCM Average Control Dela	ay		4.4	H	ICM Level	of Servic	e		A			
HCM Volume to Capacity r	atio		0.51									
Actuated Cycle Length (s)			74.0	S	um of los	t time (s)			15.0			
Intersection Capacity Utiliz	ation		58.3%	10	CU Level	of Service			В			
Analysis Period (min)			15									

		V	1	+	1	M		
Movement	EBT	EBR	WBL	WBT	NBL	NBR		
Lane Configurations	<u>ቀ</u> ቀሴ			***		1		
Volume (veh/h)	1834	47	0	1920	0	10		
Sign Control	Free			Free	Stop			
Grade	0%			0%	0%			
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97		
Hourly flow rate (vph)	1891	48	0	1979	0	10		
Pedestrians				21	21			
Lane Width (ft)				12.0	12.0			
Walking Speed (ft/s)				4.0	4.0			
Percent Blockage				2	2			
Right turn flare (veh)								
Median type	None			None				
Median storage veh)								
Upstream signal (ft)	431							
pX, platoon unblocked			0.84		0.84	0.84		
vC, conflicting volume			1960		2596	696		
vC1, stage 1 conf vol								
vC2, stage 2 conf vol								
vCu, unblocked vol			1492		2245	0		
tC, single (s)			4.1		6.8	*5.9		
tC, 2 stage (s)								
tF (s)			2.2		3.5	3.3		
p0 queue free %			100		100	99		
cM capacity (veh/h)			370		29	884		
Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	NB 1	
Volume Total	756	756	427	660	660	660	10	
Volume Left	0	0	0	0	0	0	0	
Volume Right	0	0	48	0	0	0	10	
cSH	1700	1700	1700	1700	1700	1700	884	
Volume to Capacity	0.44	0.44	0.25	0.39	0.39	0.39	0.01	
Queue Length 95th (ft)	0	0	0	0	0	0	1	
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	9.1	
Lane LOS							A	
Approach Delay (s)	0.0			0.0			9.1	
Approach LOS							А	
Intersection Summary								
Average Delay			0.0					
Intersection Capacity Utiliz	zation		52.1%	10	CU Level	of Service		
Analysis Period (min)			15					

\* User Entered Value

## HCM Unsignalized Intersection Capacity Analysis 17: Auahi St & Cooke St

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EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
	\$			4			đ î p			4î îr	
	Stop			Stop			Stop			Stop	
36	11	9	1	13	14	27	132	4	15	105	63
0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
40	12	10	1	14	16	30	147	4	17	117	70
EB1	WB 1	NB 1	NB 2	SB 1	SB 2						
62	31	103	78	75	128						
40	1	30	0	17	0						
10	16	0	4	0	70						
0.07	-0.26	0.18	-0.01	0.15	-0.35						
4.9	4.6	5.1	4.9	5.0	4.5						
0.08	0.04	0.15	0.11	0.11	0.16						
685	719	688	712	690	768						
8.3	7.8	7.8	7.3	7.4	7.2						
8.3	7.8	7.5		7.3							
А	А	А		А							
		7.6									
		А									
		34.9%	IC	U Level o	of Service			А			
		15									
	EBL          36         0.90         40         EB 1         62         40         0.07         4.9         0.08         685         8.3         A	EBL       EBT         ♣       Stop         36       11         0.90       0.90         40       12         EB1       WB1         62       31         40       1         10       16         0.07       -0.26         4.9       4.6         0.08       0.04         685       719         8.3       7.8         8.3       7.8         A       A	EBL       EBT       EBR         Stop	EBL       EBT       EBR       WBL         Stop       Stop       9       1         0.90       0.90       0.90       0.90         36       11       9       1         0.90       0.90       0.90       0.90         40       12       10       1         EB1       WB1       NB1       NB2         62       31       103       78         40       1       30       0         10       16       0       4         0.07       -0.26       0.18       -0.01         4.9       4.6       5.1       4.9         0.08       0.04       0.15       0.11         685       719       688       712         8.3       7.8       7.3       8.3         8.3       7.8       7.5       A         A       A       A       A         7.6         A       A       A         34.9%       IC         15       15	EBL         EBT         EBR         WBL         WBT           A         A         A         A         A           Stop         Stop         Stop         36         11         9         1         13           0.90         0.90         0.90         0.90         0.90         0.90         0.90           40         12         10         1         14           EB1         WB1         NB1         NB2         SB1           62         31         103         78         75           40         1         30         0         17           10         16         0         4         0           0.07         -0.26         0.18         -0.01         0.15           4.9         4.6         5.1         4.9         5.0           0.08         0.04         0.15         0.11         0.11           685         719         688         712         690           8.3         7.8         7.3         7.4           8.3         7.8         7.3         7.4           8.3         7.8         7.3         7.4           8.3	EBL       EBT       EBR       WBL       WBT       WBR         Stop       Stop       Stop       13       14         0.90       0.90       0.90       0.90       0.90       0.90         40       12       10       1       14       16         EB1       WB1       NB1       NB2       SB1       SB2         62       31       103       78       75       128         40       1       30       0       17       0         10       16       0       4       0       70         0.07       -0.26       0.18       -0.01       0.15       -0.35         4.9       4.6       5.1       4.9       5.0       4.5         0.08       0.04       0.15       0.11       0.11       0.16         685       719       688       712       690       768         8.3       7.8       7.3       7.4       7.2         8.3       7.8       7.5       7.3       A         A       A       A       A       A         A       A       A       A       A         34.9%	EBL       EBT       EBR       WBL       WBT       WBR       NBL         ♣       Stop       Stop       Stop       Stop       Stop       Stop       Stop         36       11       9       1       13       14       27         0.90       0.90       0.90       0.90       0.90       0.90       0.90         40       12       10       1       14       16       30         EB1       WB1       NB1       NB2       SB1       SB2       SB2         62       31       103       78       75       128         40       1       30       0       17       0         10       16       0       4       0       70         0.07       -0.26       0.18       -0.01       0.15       -0.35         4.9       4.6       5.1       4.9       5.0       4.5         0.08       0.04       0.15       0.11       0.16       685         685       719       688       712       690       768         8.3       7.8       7.3       7.4       7.2         8.3       7.8       7.3	EBL       EBT       EBR       WBL       WBT       WBR       NBL       NBT         Image: Stop       Stop       Stop       Stop       Stop       Stop         36       11       9       1       13       14       27       132         0.90       0.90       0.90       0.90       0.90       0.90       0.90       0.90         40       12       10       1       14       16       30       147         EB1       WB1       NB1       NB2       SB1       SB2	EBL       EBT       EBR       WBL       WBT       WBR       NBL       NBT       NBR         Stop       Stop       Stop       Stop       Stop       Stop       Stop         36       11       9       1       13       14       27       132       4         0.90 <td>EBL       EBT       EBR       WBL       WBT       WBR       NBL       NBT       NBR       SBL         G       <thg< th="">       G       <thg< th=""> <thg< th=""></thg<></thg<></thg<></td> <td>EBL       EBT       EBR       WBL       WBT       WBR       NBL       NBT       NBR       SBL       SBT         Image: Stop       Stop       Stop       Stop       Stop       Stop       Image: Stop</td>	EBL       EBT       EBR       WBL       WBT       WBR       NBL       NBT       NBR       SBL         G <thg< th="">       G       <thg< th=""> <thg< th=""></thg<></thg<></thg<>	EBL       EBT       EBR       WBL       WBT       WBR       NBL       NBT       NBR       SBL       SBT         Image: Stop       Stop       Stop       Stop       Stop       Stop       Image: Stop

## HCM Signalized Intersection Capacity Analysis 5: Ala Moana Blvd & Cooke St

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Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	ሻ	<b>4</b> 4î>		ሻ	<b>ተ</b> ትጉ	-		ર્સ	7		କ	7
Volume (vph)	57	2321	16	4	1773	39	26	31	7	51	20	124
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0			5.0	5.0		5.0	5.0
Lane Util. Factor	1.00	0.91		1.00	0.91			1.00	1.00		1.00	1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00			1.00	0.96		1.00	0.96
Flpb, ped/bikes	1.00	1.00		1.00	1.00			1.00	1.00		0.99	1.00
Frt	1.00	1.00		1.00	1.00			1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00			0.98	1.00		0.97	1.00
Satd. Flow (prot)	1770	5077		1770	5064			1817	1517		1775	1526
Flt Permitted	0.95	1.00		0.95	1.00			0.83	1.00		0.75	1.00
Satd. Flow (perm)	1770	5077		1770	5064			1535	1517		1379	1526
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	59	2393	16	4	1828	40	27	32	7	53	21	128
RTOR Reduction (vph)	0	0	0	0	1	0	0	0	6	0	0	87
Lane Group Flow (vph)	59	2409	0	4	1867	0	0	59	1	0	74	41
Confl. Peds. (#/hr)			25			20	4		25	16		20
Turn Type	Prot			Prot			Perm		Perm	Perm		Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases							8		8	4		4
Actuated Green, G (s)	7.5	71.1		0.6	64.2			11.2	11.2		11.2	11.2
Effective Green, g (s)	7.5	71.1		0.6	64.2			11.2	11.2		11.2	11.2
Actuated g/C Ratio	0.08	0.73		0.01	0.66			0.11	0.11		0.11	0.11
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)	136	3687		11	3321			176	174		158	175
v/s Ratio Prot	c0.03	c0.47		0.00	0.37							
v/s Ratio Perm								0.04	0.00		c0.05	0.03
v/c Ratio	0.43	0.65		0.36	0.56			0.34	0.00		0.47	0.24
Uniform Delay, d1	43.2	7.0		48.5	9.2			39.9	38.4		40.6	39.5
Progression Factor	1.00	1.00		1.00	1.00			1.00	1.00		1.00	1.00
Incremental Delay, d2	2.2	0.4		19.3	0.2			1.1	0.0		2.2	0.7
Delay (s)	45.4	7.4		67.7	9.4			41.1	38.4		42.8	40.1
Level of Service	D	А		E	А			D	D		D	D
Approach Delay (s)		8.3			9.5			40.8			41.1	
Approach LOS		А			А			D			D	
Intersection Summary												
HCM Average Control Delay	/		10.7	Н	ICM Level	of Service	е		В			
HCM Volume to Capacity ra	tio		0.64	-								
Actuated Cycle Length (s)			97.9	S	um of lost	time (s)			15.0			
Intersection Capacity Utiliza Analysis Period (min)	tion		82.2% 15	10	CU Level o	of Service			E			

## HCM Signalized Intersection Capacity Analysis 8: Ala Moana Blvd & Koula St

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Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	5	<b>44b</b>		ή	<b>ተ</b> ተጮ			4			<b>\$</b>	
Volume (vph)	18	2353	10	7	1794	36	1	6	3	22	1	22
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0			5.0			5.0	
Lane Util. Factor	1.00	0.91		1.00	0.91			1.00			1.00	
Frpb, ped/bikes	1.00	1.00		1.00	1.00			0.99			0.98	
Flpb, ped/bikes	1.00	1.00		1.00	1.00			1.00			0.99	
Frt	1.00	1.00		1.00	1.00			0.96			0.93	
Flt Protected	0.95	1.00		0.95	1.00			1.00			0.98	
Satd. Flow (prot)	1770	5081		1770	5061			1760			1651	
Flt Permitted	0.95	1.00		0.95	1.00			0.97			0.84	
Satd. Flow (perm)	1770	5081		1770	5061			1714			1420	laji ni
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	19	2426	10	7	1849	37	1	6	3	23	1	23
RTOR Reduction (vph)	0	0	0	0	1	0	0	3	0	0	21	0
Lane Group Flow (vph)	19	2436	0	7	1885	0	0	7	0	0	26	0
Confl. Peds. (#/hr)			20			28			20	13		28
Turn Type	Prot			Prot		1.90%	Perm		10	Perm		
Protected Phases	5	2		1	6			8			4	
Permitted Phases							8			4		
Actuated Green, G (s)	1.9	66.2		0.8	65.1			7.7			7.7	
Effective Green, g (s)	1.9	66.2		0.8	65.1			7.7			7.7	
Actuated g/C Ratio	0.02	0.74		0.01	0.73			0.09			0.09	
Clearance Time (s)	5.0	5.0		5.0	5.0			5.0			5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0			3.0	
Lane Grp Cap (vph)	37	3750		16	3673			147			122	
v/s Ratio Prot	c0.01	c0.48		0.00	0.37							
v/s Ratio Perm								0.00			c0.02	
v/c Ratio	0.51	0.65		0.44	0.51			0.05			0.21	
Uniform Delay, d1	43.4	5.9		44.2	5.4			37.6			38.2	
Progression Factor	1.00	1.00		1.00	1.00			1.00			1.00	
Incremental Delay, d2	11.5	0.4		18.0	0.1			0.1			0.9	
Delay (s)	55.0	6.3		62.2	5.5			37.8			39.1	
Level of Service	D	А		Е	А			D			D	
Approach Delay (s)		6.7			5.7			37.8			39.1	
Approach LOS		А			А			D			D	
Intersection Summary												
HCM Average Control Dela	ay		6.7	Н	ICM Leve	of Servic	e		A			
HCM Volume to Capacity r	atio		0.57						10.0			
Actuated Cycle Length (s)			89.7	S	sum of los	t time (s)			10.0			
Intersection Capacity Utilization	ation		69.9%	10	CU Level	of Service	)		С			
Analysis Period (min)			15									

		$\mathbf{r}$	1	+	1	M	
Movement	EBT	EBR	WBL	WBT	NBL	NBR	
Lane Configurations	<b>**b</b>			***		7	
Volume (veh/h)	2365	11	0	1840	0	2	
Sian Control	Free			Free	Stop		
Grade	0%			0%	0%		
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	
Hourly flow rate (vph)	2438	11	0	1897	0	2	
Pedestrians				12	12		
Lane Width (ft)				12.0	12.0		
Walking Speed (ft/s)				4.0	4.0		
Percent Blockage				1	1		
Right turn flare (veh)							
Median type	None			None			
Median storage veh)							
Upstream signal (ft)	440						
pX, platoon unblocked			0.74		0.74	0.74	
vC, conflicting volume			2461		3088	842	
vC1, stage 1 conf vol							
vC2, stage 2 conf vol							
vCu, unblocked vol			1729		2581	0	
tC, single (s)			4.1		6.8	*5.9	
tC, 2 stage (s)							
tF (s)			2.2		3.5	3.3	
p0 queue free %			100		100	100	
cM capacity (veh/h)			263		15	782	
Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	NB 1
Volume Total	975	975	499	632	632	632	2
Volume Left	0	0	0	0	0	0	0
Volume Right	0	0	11	0	0	0	2
cSH	1700	1700	1700	1700	1700	1700	782
Volume to Capacity	0.57	0.57	0.29	0.37	0.37	0.37	0.00
Queue Length 95th (ft)	0	0	0	0	0	0	0
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	9.6
Lane LOS							А
Approach Delay (s)	0.0			0.0			9.6
Approach LOS							А
Intersection Summary							
Average Delay			0.0				
Intersection Capacity Utili	zation		59.2%	10	CU Level	of Service	
Analysis Period (min)			15				

\* User Entered Value

## HCM Unsignalized Intersection Capacity Analysis 17: Auahi St & Cooke St

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Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		44			4			4î îr			€î î>	
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	61	14	11	10	14	22	19	106	8	12	179	24
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Hourly flow rate (vph)	64	15	11	10	15	23	20	110	8	12	186	25
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2						
Volume Total (vph)	90	48	75	64	106	118						
Volume Left (vph)	64	10	20	0	13	0						
Volume Right (vph)	11	23	0	8	0	25						
Hadj (s)	0.10	-0.21	0.17	-0.06	0.09	-0.11						
Departure Headway (s)	4.9	4.6	5.2	5.0	5.1	4.9						
Degree Utilization, x	0.12	0.06	0.11	0.09	0.15	0.16						
Capacity (veh/h)	684	712	662	690	682	713						
Control Delay (s)	8.6	8.0	7.7	7.3	7.8	7.6						
Approach Delay (s)	8.6	8.0	7.5		7.7							
Approach LOS	А	А	А		А							
Intersection Summary											in a f	
Delay		1.4	7.8				199					
HCM Level of Service			А									
Intersection Capacity Utilization			36.7%	IC	U Level o	of Service			А			
Analysis Period (min)			15									

## **APPENDIX E**

## CAPACITY ANALYSIS CALCULATIONS PROJECTED YEAR 2017 PEAK PERIOD TRAFFIC ANALYSIS WITH PROJECT

## HCM Signalized Intersection Capacity Analysis 5: Ala Moana Blvd & Cooke St

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Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	ሻ	<b>4</b> 4¢		ή	<b>ለ</b> ትጮ	3		Â	r"		ર્લ	7
Volume (vph)	100	1881	44	11	1902	37	19	14	7	28	21	63
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0			5.0	5.0		5.0	5.0
Lane Util. Factor	1.00	0.91		1.00	0.91			1.00	1.00		1.00	1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00			1.00	0.98		1.00	0.97
Flpb, ped/bikes	1.00	1.00		1.00	1.00			1.00	1.00		1.00	1.00
Frt	1.00	1.00		1.00	1.00			1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00			0.97	1.00		0.97	1.00
Satd. Flow (prot)	1770	5063		1770	5068			1804	1550		1805	1542
Flt Permitted	0.95	1.00		0.95	1.00			0.79	1.00		0.80	1.00
Satd. Flow (perm)	1770	5063		1770	5068			1466	1550		1495	1542
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adi, Flow (vph)	103	1939	45	11	1961	38	20	14	7	29	22	65
RTOR Reduction (vph)	0	1	0	0	1	0	0	0	6	0	0	60
Lane Group Flow (vph)	103	1983	0	11	1998	0	0	34	1	0	51	5
Confl. Peds. (#/hr)			8	55 BU		12	5		8	5	5.000	12
Turn Type	Prot	1.00		Prot			Perm		Perm	Perm		Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases							8		8	4		4
Actuated Green, G (s)	11.5	71.9		1.1	61.5			7.3	7.3		7.3	7.3
Effective Green, g (s)	11.5	71.9		1.1	61.5			7.3	7.3		7.3	7.3
Actuated g/C Ratio	0.12	0.75		0.01	0.65			0.08	0.08		0.08	0.08
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)	214	3820		20	3271			112	119		115	118
v/s Ratio Prot	c0.06	c0.39		0.01	c0.39							
v/s Ratio Perm								0.02	0.00		c0.03	0.00
v/c Ratio	0.48	0.52		0.55	0.61			0.30	0.00		0.44	0.04
Uniform Delay, d1	39.1	4.7		46.9	9.9			41.6	40.6		42.1	40.8
Progression Factor	1.00	1.00		1.00	1.00			1.00	1.00		1.00	1.00
Incremental Delay, d2	1.7	0.1		28.9	0.3			1.5	0.0		2.7	0.1
Delay (s)	40.8	4.8		75.7	10.2			43.1	40.7		44.8	40.9
Level of Service	D	А		E	В			D	D		D	D
Approach Delay (s)		6.6			10.6			42.7			42.6	
Approach LOS		А			В			D			D	
Intersection Summary												
HCM Average Control Dela	ay	7 24	9.8	Н	ICM Level	of Servic	е		А			
HCM Volume to Capacity r	atio		0.62									
Actuated Cycle Length (s)	19 10 1 - 4T		95.3	S	um of lost	t time (s)			20.0			
Intersection Capacity Utiliz	ation		68.5%	10	CU Level o	of Service			С			
Analysis Period (min)	15.6103:		15									

## HCM Signalized Intersection Capacity Analysis 8: Ala Moana Blvd & Koula St

	٨	-	>	1	-	A.	1	1	1	1	Ļ	~
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	Ϋ	<b>ተተ</b> ጮ		ή	<b>ተተ</b> ጮ			<b>\$</b>			<b>\$</b>	
Volume (vph)	28	1873	15	6	1925	9	5	4	4	49	7	23
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	
Lane Util. Factor	1.00	0.91		1.00	0.91			1.00			1.00	
Frpb, ped/bikes	1.00	1.00		1.00	1.00			0.99			0.99	
Flpb, ped/bikes	1.00	1.00		1.00	1.00			1.00			0.99	
Frt	1.00	1.00		1.00	1.00			0.96			0.96	
Flt Protected	0.95	1.00		0.95	1.00			0.98			0.97	
Satd. Flow (prot)	1770	5077		1770	5080			1734			1693	
Flt Permitted	0.95	1.00		0.95	1.00			0.91			0.80	
Satd. Flow (perm)	1770	5077		1770	5080			1603		Star Lines	1402	
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	29	1931	15	6	1985	9	5	4	4	51	7	24
RTOR Reduction (vph)	0	1	0	0	0	0	0	4	0	0	12	0
Lane Group Flow (vph)	29	1945	0	6	1994	0	0	9	0	0	70	0
Confl. Peds. (#/hr)			17			26			20	20		26
Turn Type	Prot			Prot			Perm			Perm		
Protected Phases	5	2		1	6			8			4	
Permitted Phases							8			4		
Actuated Green, G (s)	3.9	61.7		0.9	58.7			8.3			8.3	
Effective Green, g (s)	3.9	61.7		0.9	58.7			8.3			8.3	
Actuated g/C Ratio	0.05	0.72		0.01	0.68			0.10			0.10	
Clearance Time (s)	5.0	5.0		5.0	5.0			5.0			5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0			3.0	
Lane Grp Cap (vph)	80	3647		19	3471			155			135	
v/s Ratio Prot	c0.02	c0.38		0.00	c0.39							
v/s Ratio Perm								0.01			c0.05	
v/c Ratio	0.36	0.53		0.32	0.57			0.06			0.52	
Uniform Delay, d1	39.8	5.5		42.2	7.1			35.3			36.9	
Progression Factor	1.00	1.00		1.00	1.00			1.00			1.00	
Incremental Delay, d2	2.8	0.2		9.3	0.2			0.2			3.6	
Delay (s)	42.6	5.7		51.5	7.3			35.4			40.5	
Level of Service	D	А		D	А			D			D	
Approach Delay (s)		6.2			7.5			35.4			40.5	
Approach LOS		А			А			D			D	
Intersection Summary												
HCM Average Control Dela	iy		7.6	Н	ICM Level	of Servic	e		А			
HCM Volume to Capacity ra	atio		0.60									
Actuated Cycle Length (s)			85.9	S	um of lost	time (s)			20.0			
Intersection Capacity Utilization	ation		60.7%	10	CU Level o	of Service	)		В			
Analysis Period (min)			15									

tovement         EBT         EBR         WBL         WBT         NBL         NBR           ane Configurations         \hh         \hh         \hh         \hl         \hl<         \hl<         \hl<         \hl<         \hl<         \hl<         \hl<         \hl<<         \hl<		-	$\mathbf{r}$	1	+	1	P			
ane Configurations <h></h>	Movement	EBT	EBR	WBL	WBT	NBL	NBR			
folume (veh/h)         1876         47         0         1941         0         10           ign Control         Free         Stop	Lane Configurations	<b>^</b>	UNCORPORTAL OF		***		7			
ign Control         Free         Free         Stop           rade         0%         0%         0%         0%           eak Hour Factor         0.97         0.97         0.97         0.97         0.97           ourly flow rate (vph)         1934         48         0         2001         0         10           ade Width (ft)         12.0         12.0         12.0         12.0         12.0         12.0           faiking Speed (t/k)         4.0	Volume (veh/h)	1876	47	0	1941	0	10			
Trade         0%         0%         0%         0%           eak Hour Factor         0.97         0.97         0.97         0.97         0.97           lourly flow rate (vph)         1934         48         0         2001         0         10           edestrians         21         21         21         21         21         21           ane Width (ft)         12.0         12.0         4.0         4.0         22         2           light turn flare (veh)         4.0         4.0         4.0         22         2         2           light turn flare (veh)         4.0         4.0         4.0         2         2         2           light turn flare (veh)         50         2.2         2         2         2         2           light turn flare (veh)         50         2.2         0.82         0.82         0.82         0.82         0.82         0.82         0.82         0.22         0.82         0.82         0.82         0.22         0.82         0.82         0.22         0.82         0.22         2.5         3.3         0         0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0	Sign Control	Free			Free	Stop				
eak Hour Factor       0.97       0.97       0.97       0.97       0.97       0.97         loudry flow rate (vph)       1934       48       0       2001       0       10         edestrians       21       21       21       21       21         ane Width (th)       12.0       12.0       12.0       12.0       12.0         Valking Speed (tVs)       4.0       4.0       4.0       2.0       2.2       12.0         light turn flare (veh)       None       None       None       12.0       12.0       12.0         ledian type       None       None       None       12.0       1	Grade	0%			0%	0%				
lourly flow rate (vph) 1934 48 0 2001 0 10 edestrians 21 21 ane Widh (ft) 12.0 12.0 Valking Speed (ft/s) 4.0 4.0 ercent Blockage 2 2 2 ight turn flare (veh) lecian type None None lecian storage veh) pstream signal (ft) 431 X, platoon unblocked 0.82 0.82 0.82 C, conflicting volume 2003 2646 711 C1, stage 1 conf vol C2, stage 2 conf vol C2, stage 2 conf vol C2, stage 2 conf vol C2, stage 2 conf vol C2, stage 3 2 3.3 G queue free % 100 100 99 M capacity (veh/h) 371 29 858 VB1 VB2 VB3 NB1 folume Total 774 774 435 667 667 10 folume Left 0 0 0 0 0 0 0 G queue free % 100 100 99 M capacity (veh/h) 371 29 858 VB1 VB2 VB3 NB1 folume Total 774 774 435 667 667 10 folume Left 0 0 0 0 0 0 0 0 SH 1700 1700 1700 1700 1700 1700 1700 SH 1700 1700 1700 1700 1700 1700 SH 1700 1700 1700 1700 1700 1700 1700 SH 1700 1700 1700 1700 1700 1700 1700 SH 1700 1700 1700 1700 1700 1700 1700 170	Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97			
21       21       21         ane Width (ft)       12.0       12.0         Valking Speed (ft/s)       4.0       4.0         recent Blockage       2       2         tight turn flare (veh)       12.0       12.0         ledian storage veh)       12.0       12.0         pstream signal (ft)       431       12.0         X, platoon unblocked       0.82       0.82         C, conflicting volume       2003       2646         C1, stage 1 conf vol       1454       2238         C2, stage 2 conf vol       0       1454         C2, stage (s)       5.9       2.2         F(s)       2.2       3.5       3.3         0 queue free %       100       100       99         M capacity (veh/h)       371       29       858         Virection, Lane #       EB 1       EB 2       EB 3       WB 1       MB 1         folume Total       774       774       435       667       667       10         folume Left       0       0       0       0       0       10         SH       1700       1700       1700       1700       858       100       10	Hourly flow rate (vph)	1934	48	0	2001	0	10			
ane Width (ft)       12.0       12.0         Valking Speed (ft/s)       4.0       4.0         valking Speed (ft/s)       4.0       4.0         recent Blockage       2       2         tedian type       None       None         tedian type       None       None         tedian type       None       0.82       0.82         C, conflicting volume       2003       2646       711         C1, stage 1 conf vol       1454       2238       0         C2, stage 2 conf vol       2       3.5       3.3         O queue free %       100       100       99         X capacity (veh/h)       371       29       858         Vincetion, Lane #       EB 1       EB 2       EB 3       WB 1       WB 2       WB 3       NB 1         Colume Total       774       774       435       667       667       10       100         Yolume Right       0       0       0       0       0       100       1700       1700       1700       1700       1700       1700       1700       1700       1700       1700       1700       1700       1700       1700       1700       100       0 <td>Pedestrians</td> <td></td> <td></td> <td></td> <td>21</td> <td>21</td> <td></td> <td></td> <td></td> <td></td>	Pedestrians				21	21				
Walking Speed (ft/s)       4.0       4.0         ercent Blockage       2       2         tight turn flare (veh)       1       2       2         tedian storage veh)       Pstream signal (ft)       431	ane Width (ft)				12.0	12.0				
Percent Blockage         2         2           light tum flare (veh)         None         None           ledian storage veh)         pstream signal (ft)         431           X, platoon unblocked         0.82         0.82         0.82           C, conflicting volume         2003         2646         711           C1, stage 1 conf vol         C2, stage 2 conf vol         C2, stage 2 conf vol         C2, stage 2 conf vol           C2, stage 2 conf vol         22         3.5         3.3         0           C, 2 stage (s)         2.2         3.5         3.3         0           C, 2 stage (s)         2.2         3.5         3.3         0           C (welfree %         100         100         99         M capacity (veh/h)         371         29         858           Vincetion, Lane #         EB 1         EB 2         EB 3         WB 1         WB 3         NB 1           folume total         774         774         435         667         667         10           folume to Capacity         0.46         0.26         0.39         0.39         0.01         20           SH         1700         1700         1700         1700         858         100	Walking Speed (ft/s)				4.0	4.0				
Itelian type       None       None         Hedian storage veh)       pstream signal (ft)       431	Percent Blockage				2	2				
ledian type         None         None           tedian storage veh)         431           x, platoon unblocked         0.82         0.82         0.82           c, conflicting volume         2003         2646         711           C1, stage 1 conf vol         711         711         711           C2, stage 2 conf vol         711         711         711           C1, stage 1 conf vol         711         711         711           C2, stage 2 conf vol         711         711         711           C3, stage 2 conf vol         711         712         711           C3, single (s)         4.1         6.8         *5.9           C, stage 1 conf vol         722         3.5         3.3           0 quee free %         100         100         99           M capacity (veh/h)         371         29         858           Virrection, Lane #         EB 1         EB 2         EB 3         WB 1         WB 2         WB 3         NB 1           folume Left         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0 </td <td>Right turn flare (veh)</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td>	Right turn flare (veh)									
Hedian storage veh)       431         Apitaton unblocked       0.82       0.82       0.82         C, conflicting volume       2003       2646       711         C1, stage 1 conf vol       203       2646       711         C2, stage 2 conf vol       203       2646       711         C1, stage 1 conf vol       1454       2238       0         C2, stage 2 conf vol       5       5.9       0         C2, stage (s)       4.1       6.8       *5.9         C3 (get 6 free %       100       100       99         M capacity (veh/h)       371       29       858         Interction, Lane #       EB 1       EB 2       EB 3       WB 1       WB 2       WB 3       NB 1         folume Total       774       774       435       667       667       10       10         Yeau Left       0       0       0       0       0       10       11         Yeau Left       0       0       0       0       0       11       10         Yeau Legth 95th (ft)       0       0       0       0       11       10       10         SH       1700       1700       1700	Median type	None			None					
pstream signal (ft)       431         X, platoon unblocked       0.82       0.82       0.82         Q, conflicting volume       2003       2646       711         C1, stage 1 conf vol       2       203       2646       711         C2, stage 2 conf vol       7       7       7       7       7       8       0         C, single (s)       4.1       6.8       *5.9       .	Median storage veh)									
X, platoon unblocked       0.82       0.82       0.82         C, conflicting volume       2003       2646       711         C1, stage 1 conf vol       1454       2238       0         C2, stage 2 conf vol       4.1       6.8       *5.9         C, single (s)       4.1       6.8       *5.9         C, 2 stage 2 (s)	Upstream signal (ft)	431								
C, conflicting volume         2003         2646         711           C1, stage 1 conf vol         C2, stage 2 conf vol         C2, stage 2 conf vol         C2, stage 2 conf vol           C1, unblocked vol         1454         2238         0         C3           C, single (s)         4.1         6.8         *5.9         C2           C, 2 stage (s)         -         -         -         -           F (s)         2.2         3.5         3.3         O         Output free %         100         100         99           M capacity (veh/h)         371         29         858         -	pX, platoon unblocked			0.82		0.82	0.82			
C1, stage 1 conf vol       C2, stage 2 conf vol         C2, stage 2 conf vol       1454       2238       0         C1, unblocked vol       1454       2238       0         C, stage (s)       4.1       6.8       *5.9         C, 2 stage (s)       2.2       3.5       3.3         O queue free %       100       100       99         M capacity (veh/h)       371       29       858         Direction, Lane #       EB 1       EB 2       EB 3       WB 1       WB 2       WB 3       NB 1         Volume Total       774       774       435       667       667       10       oloume to 10       State	vC, conflicting volume			2003		2646	711			
C2, stage 2 conf vol       1454       2238       0         Cu, unblocked vol       1454       2238       0         C, single (s)       4.1       6.8       *5.9         C, 2 stage (s)       -       -       -         F (s)       2.2       3.5       3.3         0 queue free %       100       100       99         M capacity (veh/h)       371       29       858         Direction, Lane #       EB 1       EB 2       EB 3       WB 1       WB 2       WB 3       NB 1         Yolume Total       774       774       435       667       667       10       0	C1. stage 1 conf vol									
Cu, unblocked vol       1454       2238       0         C, single (s)       4.1       6.8       *5.9         C, 2 stage (s)       -       -       -         F (s)       2.2       3.5       3.3         0 queue free %       100       100       99         M capacity (veh/h)       371       29       858         Direction, Lane #       EB 1       EB 2       EB 3       WB 1       WB 2       WB 3       NB 1         Volume Total       774       774       435       667       667       10	vC2, stage 2 conf vol									
C, single (s)       4.1       6.8       *5.9         C, 2 stage (s)	vCu, unblocked vol			1454		2238	0			
c) 2 stage (s)         F (s)       2.2       3.5       3.3         0 queue free %       100       100       99         M capacity (veh/h)       371       29       858         Direction, Lane #       EB 1       EB 2       EB 3       WB 1       WB 2       WB 3       NB 1         Volume Total       774       774       435       667       667       10       0         Volume Left       0       0       0       0       0       0       0       0         Olume Right       0       0.48       0       0       10       10       S58         Volume to Capacity       0.46       0.46       0.26       0.39       0.39       0.01       0.01         Queue Length 95th (ft)       0       0       0       0       1700       1700       185         Volume to Capacity (s)       0.0       0.0       0.0       0.0       9.2       0.1       0.1         Queue Length 95th (ft)       0       0       0       0       9.2       0.1       0.1       0.0       9.2       0.1       0.1       0.1       0.1       0.1       0.1       0.1       0.1       0.1	tC, single (s)			4.1		6.8	*5.9			
F (s)       2.2       3.5       3.3         0 queue free %       100       100       99         M capacity (veh/h)       371       29       858         Direction, Lane #       EB 1       EB 2       EB 3       WB 1       WB 2       WB 3       NB 1         Volume Total       774       774       435       667       667       10       667       10         Yolume Left       0       0       0       0       0       0       0       100         Yolume Right       0       0       48       0       0       10       10         SH       1700       1700       1700       1700       1700       858       100         Yolume to Capacity       0.46       0.46       0.26       0.39       0.39       0.01         Queue Length 95th (ft)       0       0       0       0       0       1700       1700         Queue Logs       0.0       0.0       0.0       0.0       9.2       2         Amptroach Delay (s)       0.0       0.0       0.0       9.2       2         Approach LOS       A       A       4       4       4	tC, 2 stage (s)									
0 queue free %       100       100       99         M capacity (veh/h)       371       29       858         Direction, Lane #       EB 1       EB 2       EB 3       WB 1       WB 2       WB 3       NB 1         Volume Total       774       774       435       667       667       10         Volume Total       774       774       435       667       667       10         Volume Left       0       0       0       0       0       0       0         Volume Right       0       0       48       0       0       0       10         SH       1700       1700       1700       1700       1700       858         Volume to Capacity       0.46       0.26       0.39       0.39       0.01         Queue Length 95th (ft)       0       0       0       0       1         Queue Longt (s)       0.0       0.0       0.0       9.2       A         Approach Delay (s)       0.0       0.0       0.0       9.2       A         Approach LOS       A       A       A       A       A         Intersection Summary       0.0       0.0       A	tF (s)			2.2		3.5	3.3			
M capacity (veh/h)       371       29       858         Virection, Lane #       EB 1       EB 2       EB 3       WB 1       WB 2       WB 3       NB 1         /olume Total       774       774       435       667       667       667       10         /olume Left       0       0       0       0       0       0       0       0         /olume Right       0       0       48       0       0       10         /olume to Capacity       0.46       0.46       0.26       0.39       0.39       0.39       0.01         Queue Length 95th (ft)       0       0       0       0       0       0       1700       1700       1700       858         /olume to Capacity       0.46       0.46       0.26       0.39       0.39       0.39       0.01         Queue Length 95th (ft)       0       0       0       0       0       0       9       2         ane LOS       A       A       A       A       A       A       A         Npproach LOS       0.0       0.0       0.0       9.2       A         A       A       A       A       A <th< td=""><td>p0 queue free %</td><td></td><td></td><td>100</td><td></td><td>100</td><td>99</td><td></td><td></td><td></td></th<>	p0 queue free %			100		100	99			
Direction, Lane #         EB 1         EB 2         EB 3         WB 1         WB 2         WB 3         NB 1           /olume Total         774         774         435         667         667         10           /olume Left         0         0         0         0         0         0         0           /olume Right         0         0         48         0         0         10           SH         1700         1700         1700         1700         1700         858           /olume to Capacity         0.46         0.26         0.39         0.39         0.01           Queue Length 95th (ft)         0         0         0         0         1           Queue Length 95th (ft)         0         0         0         0         1           Control Delay (s)         0.0         0.0         0.0         9.2           ane LOS         A         A         A           Approach LOS         A         A         A           Intersection Summary         0.0         0.0         9.2           Antersection Capacity Utilization         52.5%         ICU Level of Service         A	cM capacity (veh/h)			371		29	858			
Incomposition         Incompos	Direction Lane #	FB 1	FB 2	EB 3	WB 1	WB 2	WB 3	NB 1		
Volume Left         0 <th< td=""><td>/olume Total</td><td>774</td><td>774</td><td>435</td><td>667</td><td>667</td><td>667</td><td>10</td><td></td><td>121222</td></th<>	/olume Total	774	774	435	667	667	667	10		121222
Volume Right         0         0         48         0         0         0         10           SH         1700         1700         1700         1700         1700         858           Volume to Capacity         0.46         0.46         0.26         0.39         0.39         0.01           Queue Length 95th (ft)         0         0         0         0         0         1           Queue Length 95th (ft)         0         0         0         0         0         1           Control Delay (s)         0.0         0.0         0.0         0.0         9.2           ane LOS         A         A         A         A         A           opproach Delay (s)         0.0         0.0         9.2         A           opproach LOS         A         A         A         A           werage Delay         0.0         A         A         A           htersection Capacity Utilization         52.5%         ICU Level of Service         A           analysis Period (min)         15         15         A	Volume Left	0	0	0	0	0	0	0		
SH       1700       1700       1700       1700       1700       858         Volume to Capacity       0.46       0.46       0.26       0.39       0.39       0.01         Queue Length 95th (ft)       0       0       0       0       0       1         Control Delay (s)       0.0       0.0       0.0       0.0       9.2         ane LOS       A       A       A         opproach Delay (s)       0.0       0.0       9.2         Antersection Summary       A       A         Average Delay       0.0       A         Intersection Capacity Utilization       52.5%       ICU Level of Service       A         Analysis Period (min)       15       15       15       15	Volume Right	0	0	48	0	0	0	10		
Colume to Capacity         0.46         0.46         0.26         0.39         0.39         0.01           Queue Length 95th (ft)         0         0         0         0         0         1           Control Delay (s)         0.0         0.0         0.0         0.0         9.2           ane LOS         A         A         A         A           Approach Delay (s)         0.0         0.0         9.2           Approach LOS         A         A         A           Approach LOS         0.0         0.0         9.2           Approach LOS         0.0         0.0         9.2           Antersection Summary         0.0         A           Average Delay         0.0         0.0           Intersection Capacity Utilization         52.5%         ICU Level of Service         A           Analysis Period (min)         15         15         10         10	cSH	1700	1700	1700	1700	1700	1700	858		
Queue Length 95th (ft)       0       0       0       0       0       1         Control Delay (s)       0.0       0.0       0.0       0.0       9.2         ane LOS       A         Approach Delay (s)       0.0       0.0       9.2         Approach LOS       A         Intersection Summary       0.0       0.0         Average Delay       0.0         Intersection Capacity Utilization       52.5%       ICU Level of Service       A         Analysis Period (min)       15       15	Volume to Capacity	0.46	0.46	0.26	0.39	0.39	0.39	0.01		
Control Delay (s)         0.0         0.0         0.0         0.0         0.0         0.0         9.2           ane LOS         A         A         A         A         A         A           Approach Delay (s)         0.0         0.0         0.0         9.2         A         A           Approach LOS         A         A         A         A         A           Approach LOS         0.0         0.0         9.2         A         A           Atersection Summary         0.0         A         A         A           Atersection Capacity Utilization         52.5%         ICU Level of Service         A           Analysis Period (min)         15         15         A	Queue Length 95th (ff)	0	0	0	0	0	0	1		
ane LOS     A       Approach Delay (s)     0.0       Approach LOS     A       Antersection Summary     A       Average Delay     0.0       Intersection Capacity Utilization     52.5%       ICU Level of Service     A       Analysis Period (min)     15	Control Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	9.2		
Approach Delay (s) 0.0 0.0 9.2 Approach LOS A A A A A A A A A A	Lane LOS	0.0	0.0	2.2		2.2		А		
Antersection Summary O.0 Intersection Capacity Utilization S2.5% ICU Level of Service A Intersection Capacity Utilization 15	Approach Delay (s)	0.0			0.0			9.2		
ntersection Summary Average Delay 0.0 Intersection Capacity Utilization 52.5% ICU Level of Service A Analysis Period (min) 15	Approach LOS							А		
verage Delay     0.0       Intersection Capacity Utilization     52.5%       ICU Level of Service     A       Intersection Capacity Utilization     15	Intersection Summary					e i la cara a				
ntersection Capacity Utilization 52.5% ICU Level of Service A Analysis Period (min) 15	Average Delay			0.0						
nalysis Period (min) 15	Intersection Capacity Utilizat	tion		52.5%	10	CU Level	of Service		А	
	Analysis Period (min)			15						

\* User Entered Value

## HCM Unsignalized Intersection Capacity Analysis 17: Auahi St & Cooke St

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Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		4			\$			ፋጉ			4î î>	
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	36	11	9	1	15	14	27	132	4	15	105	63
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	40	12	10	1	17	16	30	147	4	17	117	70
Direction, Lane #	EB1	WB 1	NB 1	NB 2	SB 1	SB 2						
Volume Total (vph)	62	33	103	78	75	128						
Volume Left (vph)	40	1	30	0	17	0						
Volume Right (vph)	10	16	0	4	0	70						
Hadj (s)	0.07	-0.24	0.18	-0.01	0.15	-0.35						
Departure Headway (s)	4.9	4.6	5.1	4.9	5.0	4.6						
Degree Utilization, x	0.08	0.04	0.15	0.11	0.11	0.16						
Capacity (veh/h)	685	716	687	711	689	767						
Control Delay (s)	8.3	7.8	7.8	7.3	7.4	7.2						
Approach Delay (s)	8.3	7.8	7.6		7.3							
Approach LOS	А	А	А		А							
Intersection Summary												
Delay			7.6									
HCM Level of Service			A									
Intersection Capacity Utilization			34.9%	IC	U Level o	of Service			А			
Analysis Period (min)			15									

## HCM Signalized Intersection Capacity Analysis 5: Ala Moana Blvd & Cooke St

6/1	9/	201	14
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Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	ή	<b>11</b>		ή	<b>ተ</b> ተጮ			र्स	7		<del>د</del> اً	7
Volume (vph)	57	2364	16	4	1804	39	26	31	7	51	20	124
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0			5.0	5.0		5.0	5.0
Lane Util. Factor	1.00	0.91		1.00	0.91			1.00	1.00		1.00	1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00			1.00	0.96		1.00	0.96
Flpb, ped/bikes	1.00	1.00		1.00	1.00			1.00	1.00		0.99	1.00
Frt	1.00	1.00		1.00	1.00			1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00			0.98	1.00		0.97	1.00
Satd. Flow (prot)	1770	5077		1770	5064			1817	1516		1775	1525
FIt Permitted	0.95	1.00		0.95	1.00			0.83	1.00		0.75	1.00
Satd. Flow (perm)	1770	5077	1.	1770	5064			1534	1516		1379	1525
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	59	2437	16	4	1860	40	27	32	7	53	21	128
RTOR Reduction (vph)	0	0	0	0	1	0	0	0	6	0	0	86
Lane Group Flow (vph)	59	2453	0	4	1899	0	0	59	1	0	74	42
Confl. Peds. (#/hr)			25			20	4		25	16		20
Turn Type	Prot			Prot			Perm		Perm	Perm		Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases							8		8	4		4
Actuated Green, G (s)	7.5	73.5		0.6	66.6			11.3	11.3		11.3	11.3
Effective Green, g (s)	7.5	73.5		0.6	66.6			11.3	11.3		11.3	11.3
Actuated g/C Ratio	0.07	0.73		0.01	0.66			0.11	0.11		0.11	0.11
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)	132	3717		11	3359			173	171		155	172
v/s Ratio Prot	c0.03	c0.48		0.00	0.37							
v/s Ratio Perm								0.04	0.00		c0.05	0.03
v/c Ratio	0.45	0.66		0.36	0.57			0.34	0.00		0.48	0.24
Uniform Delay, d1	44.5	7.0		49.7	9.1			41.1	39.6		41.8	40.7
Progression Factor	1.00	1.00		1.00	1.00			1.00	1.00		1.00	1.00
Incremental Delay, d2	2.4	0.4		19.3	0.2			1.2	0.0		2.3	0.7
Delay (s)	46.9	7.4		69.0	9.3			42.3	39.6		44.1	41.4
Level of Service	D	А		E	А			D	D		D	D
Approach Delay (s)		8.3			9.4			42.0			42.4	
Approach LOS		А			А			D			D	
Intersection Summary												
HCM Average Control Dela	у		10.7	Н	CM Level	of Service	9		В			
HCM Volume to Capacity ra	atio		0.65									
Actuated Cycle Length (s)			100.4	S	um of lost	t time (s)			15.0			
Intersection Capacity Utiliza Analysis Period (min)	ition		83.0% 15	10	CU Level o	of Service			E			

c Critical Lane Group

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## HCM Signalized Intersection Capacity Analysis 8: Ala Moana Blvd & Koula St

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Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	Ϋ́	<u> </u>		ሻ	<b>ተ</b> ትጮ			4			\$	
Volume (vph)	61	2353	10	7	1809	43	1	6	3	54	1	38
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	
Lane Util. Factor	1.00	0.91		1.00	0.91			1.00			1.00	
Frpb, ped/bikes	1.00	1.00		1.00	1.00			0.99			0.98	
Flpb, ped/bikes	1.00	1.00		1.00	1.00			1.00			0.99	
Frt	1.00	1.00		1.00	1.00			0.96			0.95	
Flt Protected	0.95	1.00		0.95	1.00			1.00			0.97	
Satd. Flow (prot)	1770	5080		1770	5055			1764			1663	
Flt Permitted	0.95	1.00		0.95	1.00			0.97			0.81	
Satd. Flow (perm)	1770	5080		1770	5055		Sal- no	1726	al mar		1394	m -
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	63	2426	10	7	1865	44	1	6	3	56	1	39
RTOR Reduction (vph)	0	0	0	0	2	0	0	3	0	0	20	0
Lane Group Flow (vph)	63	2436	0	7	1907	0	0	7	0	0	76	0
Confl. Peds. (#/hr)			20			28			13	13		28
Turn Type	Prot			Prot			Perm			Perm		
Protected Phases	5	2		1	6			8			4	
Permitted Phases							8			4		
Actuated Green, G (s)	7.6	72.5		1.1	66.0			11.3			11.3	
Effective Green, g (s)	7.6	72.5		1.1	66.0			11.3			11.3	
Actuated g/C Ratio	0.08	0.73		0.01	0.66			0.11			0.11	
Clearance Time (s)	5.0	5.0		5.0	5.0			5.0			5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0			3.0	
Lane Grp Cap (vph)	135	3687		19	3340			195			158	
v/s Ratio Prot	c0.04	c0.48		0.00	0.38							
v/s Ratio Perm								0.00			c0.05	
v/c Ratio	0.47	0.66		0.37	0.57			0.04			0.48	
Uniform Delay, d1	44.2	7.2		49.1	9.2			39.5			41.6	
Progression Factor	1.00	1.00		1.00	1.00			1.00			1.00	
Incremental Delay, d2	2.5	0.5		11.7	0.2			0.1			2.3	
Delay (s)	46.7	7.7		60.7	9.5			39.5			43.9	
Level of Service	D	А		E	А			D			D	
Approach Delay (s)		8.7			9.7			39.5			43.9	
Approach LOS		А			А			D			D	
Intersection Summary												
HCM Average Control Dela	ay		9.9	Н	CM Level	of Service	Э		А			
HCM Volume to Capacity r	atio		0.65									
Actuated Cycle Length (s)			99.9	S	um of lost	time (s)			15.0			
Intersection Capacity Utiliz	ation		76.3%	IC	CU Level o	of Service			D			
Analysis Period (min)			15									

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Movement	EBT	EBR	WBL	WBT	NBL	NBR		
Lane Configurations	<b>**î</b> >			<u> </u>		7		
Volume (veh/h)	2397	11	0	1862	0	2		
Sign Control	Free			Free	Stop			
Grade	0%			0%	0%			
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97		
Hourly flow rate (vph)	2471	11	0	1920	0	2		
Pedestrians				12	12			
Lane Width (ft)				12.0	12.0			
Walking Speed (ft/s)				4.0	4.0			
Percent Blockage				1	1			
Right turn flare (veh)								
Median type	None			None				
Median storage veh)								
Upstream signal (ft)	431							
pX, platoon unblocked			0.73		0.73	0.73		
vC, conflicting volume			2494		3129	853		
vC1, stage 1 conf vol								
vC2, stage 2 conf vol								
vCu, unblocked vol			1741		2614	0		
tC, single (s)			4.1		6.8	*5.9		
tC, 2 stage (s)								
tF (s)			2.2		3.5	3.3		
p0 queue free %			100		100	100		
cM capacity (veh/h)			257		14	773		
Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	NB 1	
Volume Total	988	988	506	640	640	640	2	
Volume Left	0	0	0	0	0	0	0	
Volume Right	0	0	11	0	0	0	2	
cSH	1700	1700	1700	1700	1700	1700	773	
Volume to Capacity	0.58	0.58	0.30	0.38	0.38	0.38	0.00	
Queue Length 95th (ft)	0	0	0	0	0	0	0	
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	9.7	
Lane LOS							А	
Approach Delay (s)	0.0			0.0			9.7	
Approach LOS							А	
Intersection Summary								
Average Delay			0.0					
Intersection Capacity Utilization	n		59.9%	IC	U Level o	of Service		В
Analysis Period (min)			15					

\* User Entered Value

## HCM Unsignalized Intersection Capacity Analysis 17: Auahi St & Cooke St

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Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		4			¢ĵ.			đ î b			đ î b	
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	61	15	11	10	15	22	19	106	8	12	179	24
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Hourly flow rate (vph)	64	16	11	10	16	23	20	110	8	12	186	25
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2		2 Daniel				- And
Volume Total (vph)	91	49	75	64	106	118						
Volume Left (vph)	64	10	20	0	13	0						
Volume Right (vph)	11	23	0	8	0	25						
Hadj (s)	0.10	-0.20	0.17	-0.06	0.09	-0.11						
Departure Headway (s)	4.9	4.7	5.2	5.0	5.1	4.9						
Degree Utilization, x	0.12	0.06	0.11	0.09	0.15	0.16						
Capacity (veh/h)	684	711	661	689	681	712						
Control Delay (s)	8.6	8.0	7.7	7.3	7.8	7.6						
Approach Delay (s)	8.6	8.0	7.5		7.7							
Approach LOS	А	А	А		А							
Intersection Summary	17.8											
Delay			7.8				a partie			1.1.1.1.1.1.1		
HCM Level of Service			А									
Intersection Capacity Utilization			36.7%	IC	U Level o	of Service			А			
Analysis Period (min)			15									

6/19/2014