
TRAFFIC IMPACT ANALYSIS REPORT CENTRAL MAUI REGIONAL SPORTS COMPLEX

KAHULUI, MAUI, HAWAII

May 20, 2014

Prepared for:

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TRAFFIC IMPACT ANALYSIS REPORT

CENTRAL MAUI REGIONAL PARK

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TRAFFIC IMPACT ANALYSIS REPORT

CENTRAL MAUI REGIONAL SPORTS COMPLEX

Kahului, Maui, Hawaii

I. INTRODUCTION

This report documents the findings of a traffic study conducted by Austin, Tsutsumi & Associates, Inc. (ATA) to evaluate the potential traffic impacts resulting from the proposed Central Maui Regional Sports Complex, which will include approximately 65 acres of recreational park space (hereinafter referred to as the 'Project'), located in Kahului, Maui, Hawaii.

A. Project Description

The Project plans to provide approximately 65 acres of recreational park space on an undeveloped parcel fronting Kuihelani Highway. The Project will include two (2) phases of development. The Phase 1 of the development will include four (4) little league baseball fields, four (4) softball fields, three (3) full-size soccer fields, one (1) baseball field, two (2) concession/restroom buildings, two (2) restroom buildings, a small drainage retention area, and approximately 600 parking stalls with primary vehicle access via South Kamehameha Avenue. Phase 2, as part of the proposed Waiale Development, will increase the size of the drainage retention area, provide two (2) vehicle accesses along what is referred to as 'Road C', and restrict the vehicle access off of South Kamehameha Avenue to maintenance and emergency vehicles only.

Figure 1 illustrates the location and study intersections for the Project. The Project Site Map is included as Figure 2.



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PREPARED BY PBR HAWAII

APRIL 23, 2014



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PROJECT SITE MAP

EXHIBIT

2



B. Location

The Project is located in Kahului, on the island of Maui. The project site is located along the west side of Kuihelani Highway between Maui Lani Parkway and Waiko Road, and is bordered to the north by the Maui Lani Legends 2 residential development. Undeveloped parcels border the Project to the south and west, with planned future development including a community center, middle school, county housing, and the Waiale Project development. The Project site is more specifically identified as TMK: (2) 3-8-007:101.

C. Study Methodology

This study will address the following:

1. Existing traffic operations at key locations within the study area during the PM and Saturday peak hours of traffic.
2. Traffic projections for Base Year 2015 and 2022 (without the Project) including traffic generated by an annual defacto growth rate, consistent with the Maui Regional Long-Range Land Transportation Plan (MRTP), and other known developments in the vicinity of the Project. These other known developments in consideration are projects that are currently under construction as well as known new/future developments that are anticipated to affect traffic demand and operations within the study area.
3. Identification of potential traffic conditions for the Base Year 2015 and 2022.
4. Trip generation and traffic conditions for the proposed Project.
5. Determination of the impact of Project-generated traffic.
6. Recommendations for roadway improvements or other traffic mitigative measures, as appropriate, to reduce or eliminate the adverse impacts resulting from traffic generated by the Project.

D. Analysis Methodology

Level of Service (LOS) is a qualitative measure used to describe the conditions of traffic flow at intersections, with values ranging from free-flow conditions at LOS A to congested conditions at LOS F. The Highway Capacity



Manual – Special Report 209 (HCM), dated 2000, includes methods for calculating volume to capacity ratios, delays, and corresponding Levels of Service that were utilized in this study. LOS definitions for signalized and unsignalized intersections are provided in Appendix B.

II. EXISTING CONDITIONS

A. Roadway System

The following are brief descriptions of the existing roadways in the vicinity of the Project:

Maui Lani Parkway is generally an east-west, two-lane, two-way county collector roadway. This roadway begins to the west at its intersection with Waiale Road and Kuikahi Road, and terminates to the east at its intersection with Kuihelani Highway. West of Kamehameha Avenue, this roadway is divided with a posted speed limit of 30 miles per hour (mph). East of Kamehameha Avenue, this roadway is undivided with a posted speed limit of 20 mph.

Kamehameha Avenue is a north-south, two-lane, two-way undivided county collector roadway with a speed limit of 20 mph. This roadway begins to the north at a T-intersection with Hana Highway and terminates approximately 1,600 feet to the south of its intersection with Maui Lani Parkway at the third driveway to Pomaikai Elementary School.

Kuihelani Highway is a north-south, four-lane, two-way divided state highway with posted speed limits ranging between 45 and 55 mph. This roadway begins to the north at its intersection with Puunene Avenue where it continues to the north as Dairy Road, and terminates to the south at its intersection with Honoapiilani Highway.

B. Existing Traffic Volumes

Due to its proximity to the Project, the following intersection was studied:

- Maui Lani Parkway/Kamehameha Avenue (unsignalized)

The Weekday Evening (PM) and Saturday (SAT) peak hour turning movement data utilized in this report was collected on Tuesday, December 4th,

2012 and Saturday, April 6th, 2013. Based on this traffic count data, the weekday PM peak hour of traffic was determined to be from 4:00 PM to 5:00 PM and the SAT peak hour of traffic was determined to be from 11:30 AM to 12:30 PM. The traffic count data is provided in Appendix A. The Weekday Morning (AM) peak hour was not studied due to minimal trips forecast to be generated by the Project during this time period.

C. Existing Traffic Conditions Analysis and Observations

The existing all-way stop-controlled intersection at Maui Lani Parkway/Kamehameha Avenue has flashing beacons on all approaches. Marked crosswalks are provided on the northbound and eastbound approaches. Pomaikai Elementary School is located along the west side of Kamehameha Avenue, approximately 700 feet to the south of its intersection with Maui Lani Parkway.

The study intersection was observed to operate with significant delay during the PM peak hour of traffic. The eastbound and westbound approaches were observed to operate at LOS F and overcapacity conditions. All other movements were observed to operate at LOS D or better during the PM peak hour. These observations confirmed the traffic analysis results.

Intersection operations during the Saturday peak hour of traffic were observed to operate satisfactorily, with LOS C or better on all approaches.

Based on existing traffic counts, the Maui Lani Parkway/Kamehameha Avenue intersection currently meets the four-hour traffic warrant for a signalized intersection. Appendix D shows the existing 2013 traffic volumes plotted against the four-hour traffic warrant curves given in the Manual on Uniform Traffic Control Devices (MUTCD), Chapter 4.

Table 1 below provides the existing delay, volume-to-capacity ratio (V/C), and LOS for the study intersection, with the full LOS summary tables provided in Appendix C. Existing traffic volumes, lane configurations and movement LOS are illustrated in Figure 3.



Table 1:
Existing Level of Service

Approach	PM Peak Hour			SAT Peak Hour		
	Delay	V/C	LOS	Delay	V/C	LOS
1 – Kamehameha Avenue & Maui Lani Parkway						
Eastbound	113.6	1.14	F*	24.2	0.72	C
Westbound	100.3	1.11	F*	19.9	0.64	C
Northbound	14.4	0.23	B	11.2	0.13	B
Southbound	32.6	0.66	D	15.7	0.50	C
OVERALL	75.3	0.91	F	19.0	0.61	B

*Over capacity conditions.



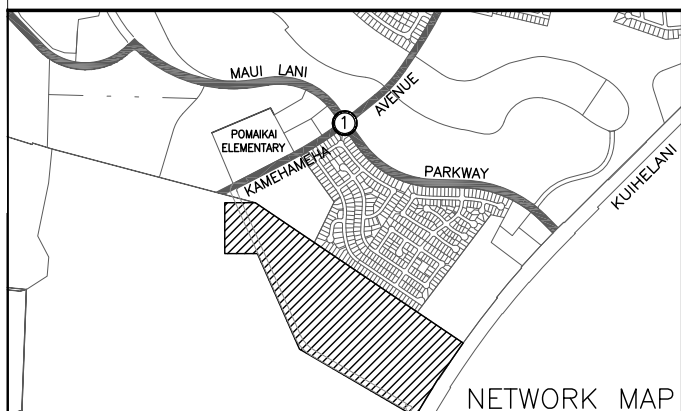
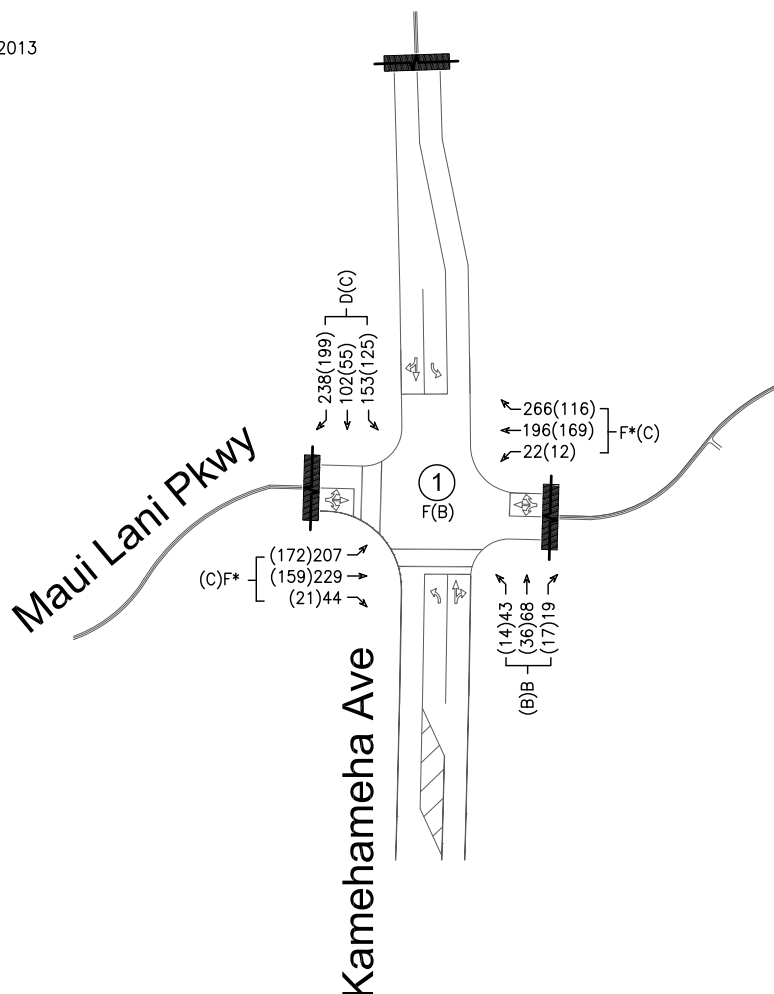
NOT TO SCALE

DATE OF COUNTS:
DECEMBER 4, 2012 & APRIL 6, 2013

PM PEAK HOUR:
4:00 PM - 5:00 PM

SATURDAY MD PEAK HOUR:
11:30 AM - 12:30 PM

NOTE:
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LEGEND

- ##(##) - PM(SAT) PEAK HOUR OF TRAFFIC VOLUMES
- X(X) - PM(SAT) LOS
- Y - INTERSECTION Y
- * - OVERCAPACITY, $V/C \geq 1$

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EXISTING 2012-2013 CONDITIONS -
LANE CONFIGURATION, TRAFFIC VOLUMES, AND LOS

FIGURE

3



III. BASE YEAR TRAFFIC ANALYSIS WITHOUT THE PROJECT

The year 2015 was selected as the base year to reflect the anticipated completion year and full occupancy of Phase 1 of the Project. The year 2022 was selected as the base year to reflect the anticipated completion year and full occupancy of Phase 2 of the Project to coincide with the full build out of the Waiale Development.

A. Defacto Growth Rate

A defacto growth rate for each movement of the study intersection was derived from the MRTP. These defacto growth rates ranged from 2.0 to 4.4 percent per year.

B. Other Known Developments

The future developments in the area that are anticipated to have a transportation impact on the study intersection are the following:

By Base Year 2015

- Maui Lani Residential – Mostly Single-Family Residential, defined as the entire Maui Lani development excluding the Maui Lani Commercial (VMX-C/R) parcel. Approximately 30 percent of the residential component is complete and is anticipated to increase at a rate of one (1) dwelling unit per week.
- Maui Lani Commercial (VMX-C/R) – Commercial/Retail with Light Industrial and Single-Family Residential. This development is currently under construction and is anticipated to be completed over several phases through 2027.
- Kehalani – Commercial space, residential units and an elementary school. This development is approximately 50 percent complete.

By Base Year 2022

- Waikapu Country Town – Commercial space and residential units near the existing Maui Tropical Plantation. This development is currently in the planning stages and is anticipated to begin occupancy in year 2020.

- Waiale Development – Single-Family and Multi-Family Residential along with commercial space, industrial space, and a middle school. This development is currently in the planning stages and is anticipated to be complete by year 2022.

These future developments are included in the traffic projections from the MRTTP. As these land uses are already included in the defacto growth rate at the study intersection, no additional traffic volumes were added to the Base Year 2015 forecast. However, the Waiale Development is anticipated to be completed concurrently with Phase 2 of the Project and was not adequately represented by the MRTTP at the study intersection. Traffic volumes associated with the full build and occupancy of the Waiale Development by year 2022 was determined using the Waiale Development Traffic Impact Analysis Report TIAR published by ATA in March of 2011 and supplemental trip generation for the Saturday peak hour using the Trip Generation Manual, 9th Edition as shown in Appendix E.

The vehicle traffic generated by the Waiale development, as indicated in the Waiale Development TIAR, was distributed through the study intersection consistent with the report as background volumes for year 2022. The same distribution was used for a proportionate amount of forecast Saturday peak hour volumes.

In addition, the Waiale Development will include new roadways adjacent to the Project, hereinafter referred to as 'Road B' and 'Road C'. These two (2) roadways are currently planned to create a T-intersection with the minor stop-controlled movement, Road B, terminating at the Project site. Kamehameha Avenue would also be extended further to the south and create a direct connection between Maui Lani Parkway and the Waiale Development site.

C. Results of Intersection Analysis

Base Year 2015

At the time of this report, a traffic signal is under design and is assumed to be installed at the Kamehameha Avenue/Maui Lani Parkway intersection by Base Year 2015. Separate left-turn, through, and right-turn lanes are assumed to be included for the westbound and eastbound approaches with the installation

of the traffic signal, as indicated in the Onehee Avenue Extension TIAR published by ATA in April, 2013. The traffic signal is forecast to operate at overall LOS B during the PM and Saturday peak hours, with all approaches operating at LOS C or better.

Base Year 2022

Traffic conditions at the study intersection without any improvements besides the ones described above would yield LOS E and nearly reach overcapacity conditions on several movements during the PM peak hour by year 2022. The Road C/Road B intersection will operate at LOS B or better on all movements except for the northbound left-turn, which will operate at LOS F. In order to mitigate these traffic conditions, the following improvements are recommended:

- Kamehameha Avenue/Maui Lani Parkway

Mitigation:

- o Northbound and southbound approaches: Provide exclusive left-turn, through, and right-turn lanes.

- Road C/Road B

Mitigation:

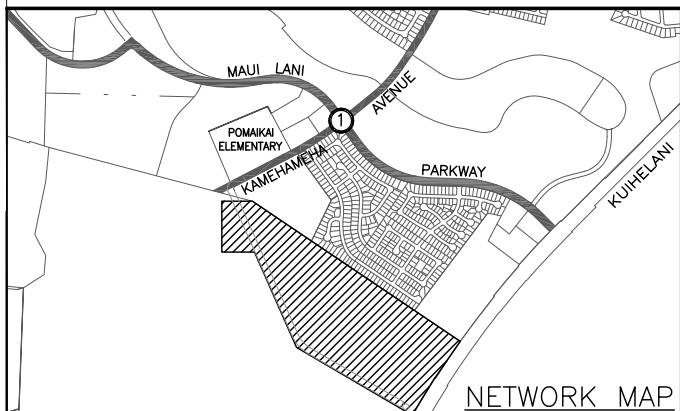
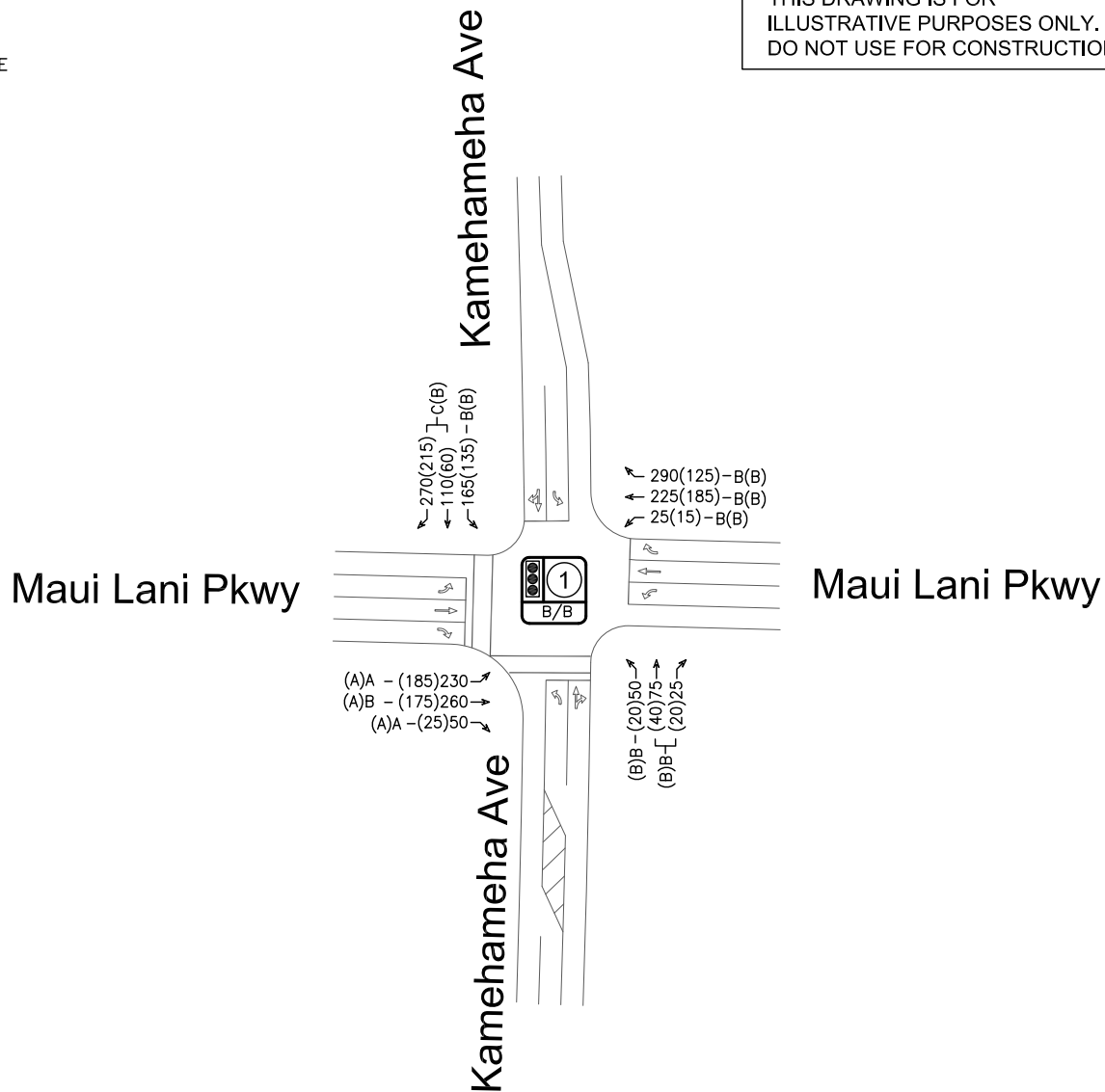
- o Based upon forecast traffic volumes associated with nearby development before construction of the proposed Project, a traffic signal may be warranted by 2022. It is recommended that the intersection be monitored after construction to determine when and if the intersection meets traffic signal warrants.

Figures 4-6 provide illustrations of the forecast traffic volumes, lane configurations and movement LOS for Base Year 2015, Base Year 2022, and Base Year 2022 with Mitigation conditions, respectively. Table 2 shows the Base Year 2015, 2022, and 2022 with Mitigation LOS at the study intersection, with the full LOS summary tables provided in Appendix C.



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LEGEND

- ##(##) - PM(SAT) PEAK HOUR OF TRAFFIC VOLUMES
- X(X) - PM(SAT) LOS
- SIGNALIZED INTERSECTION Y, OVERALL PM/SAT LOS
- * - OVERCAPACITY, V/C >= 1

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BASE YEAR 2015 -
LANE CONFIGURATION, TRAFFIC VOLUMES, AND LOS

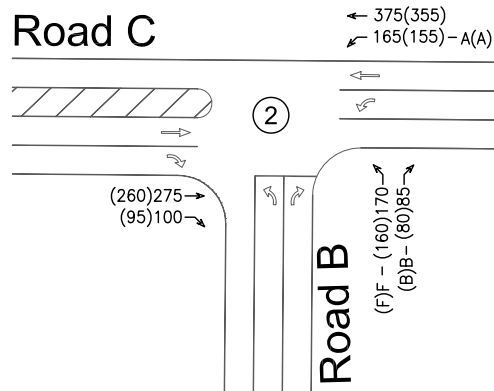
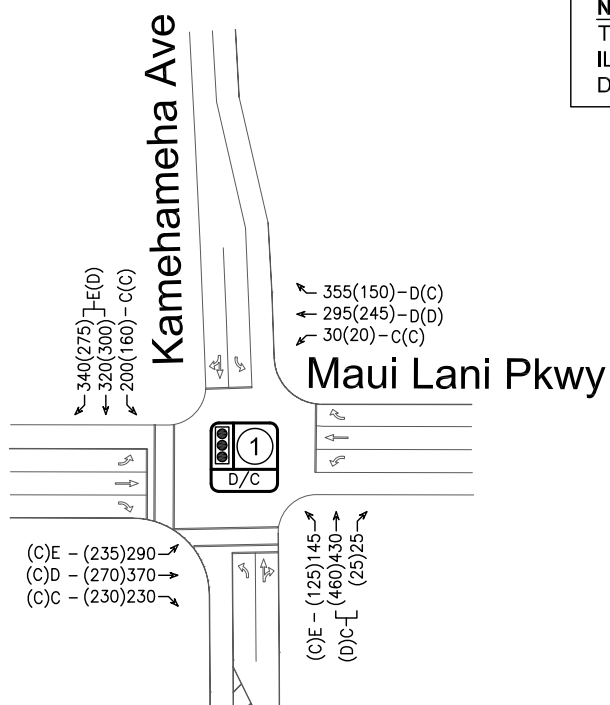
FIGURE

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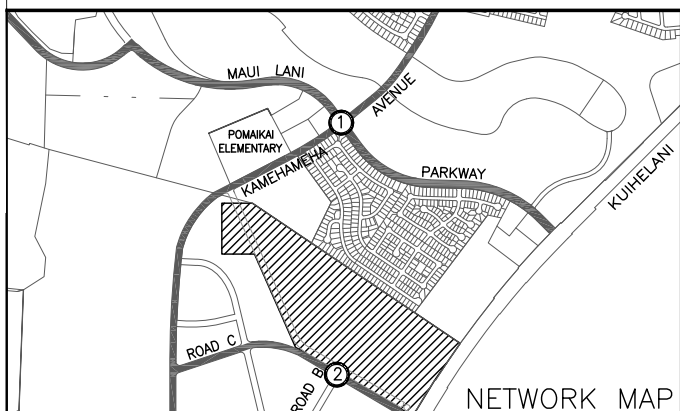
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LEGEND

- ##(##) - PM(SAT) PEAK HOUR OF TRAFFIC VOLUMES
- X(X) - PM(SAT) LOS
-  - SIGNALIZED INTERSECTION Y, OVERALL PM/SAT LOS
-  - INTERSECTION Y
- * - OVERCAPACITY, $V/C \geq 1$



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BASE YEAR 2022 -
LANE CONFIGURATION, TRAFFIC VOLUMES, AND LOS

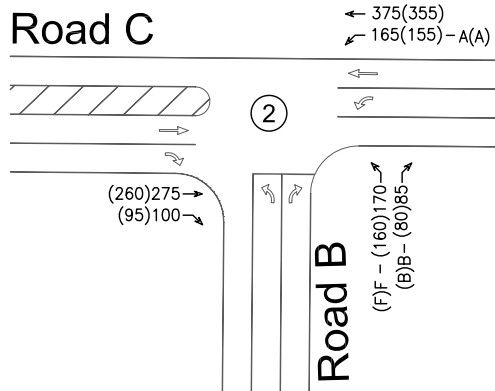
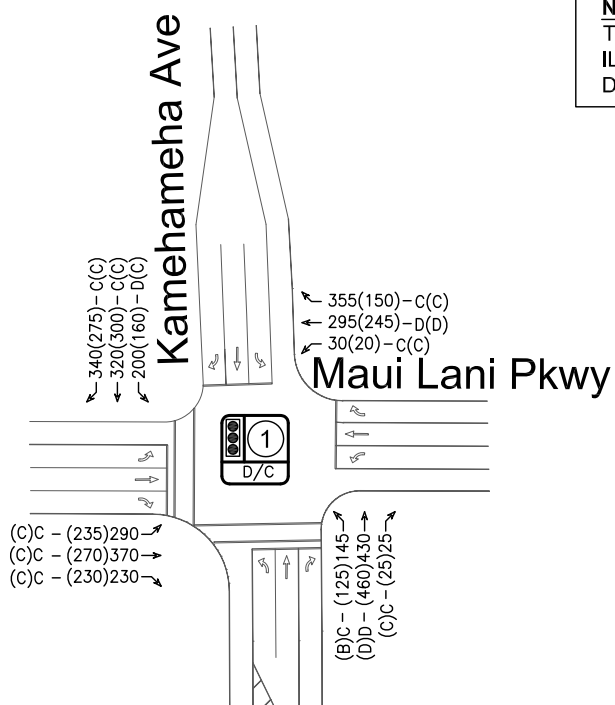
FIGURE

5



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LEGEND

##(##) - PM(SAT) PEAK HOUR OF TRAFFIC VOLUMES

X(X) - PM(SAT) LOS

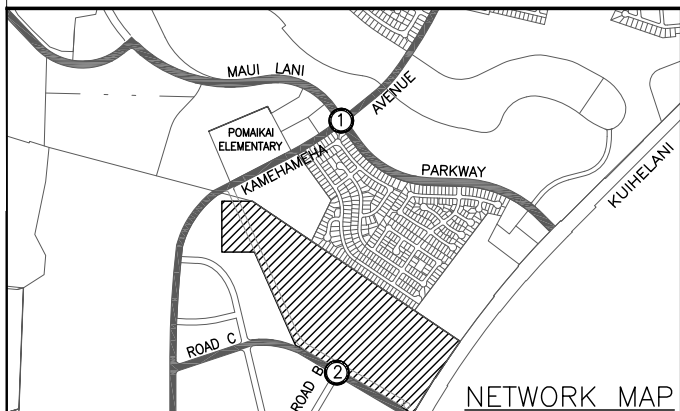


- SIGNALIZED INTERSECTION Y, OVERALL PM/SAT LOS



- INTERSECTION Y

* - OVERCAPACITY, $V/C \geq 1$



NETWORK MAP

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BASE YEAR 2022 WITH MITIGATION -
LANE CONFIGURATION, TRAFFIC VOLUMES, AND LOS

FIGURE

6

Table 2: Base Year 2015, Base Year 2022, and Base Year 2022 with Mitigation LOS

PM Peak Hour	Base Year 2015			Base Year 2022			Base Year 2022 w/ Mit.		
Intersection/Movement	Delay	V/C	LOS	Delay	V/C	LOS	Delay	V/C	LOS
1 - Kamehameha Avenue & Maui Lani Parkway									
Eastbound Left-Turn	7.8	0.39	A	63.7	0.94	E	30.0	0.77	C
Eastbound Thru	11.0	0.34	B	37.0	0.67	D	28.1	0.59	C
Eastbound Right-Turn	9.3	0.03	A	28.3	0.17	C	22.3	0.16	C
Westbound Left-Turn	13.6	0.07	B	32.9	0.15	C	27.7	0.11	C
Westbound Thru	17.4	0.43	B	48.9	0.75	D	40.4	0.71	D
Westbound Right-Turn	15.8	0.20	B	38.4	0.39	D	32.4	0.33	C
Northbound Left-Turn	19.4	0.40	B	73.5	0.92	E	21.6	0.41	C
Northbound Thru	--	--	--	--	--	--	43.1	0.83	D
Northbound Thru-Right	16.5	0.18	B	34.3	0.71	C	--	--	--
Northbound Right-Turn	--	--	--	--	--	--	25.2	0.02	C
Southbound Left-Turn	19.0	0.49	B	22.7	0.62	C	30.5	0.72	C
Southbound Thru	--	--	--	--	--	--	31.4	0.59	C
Southbound Thru-Right	22.0	0.64	C	57.2	0.96	E	--	--	--
Southbound Right	--	--	--	--	--	--	26.4	0.23	C
Overall Delay	15.8	0.51	B	45.0	0.98	D	31.6	0.81	C
2 - Road C & Road B									
Westbound Left-Turn	--	--	--	8.7	0.16	A	8.7	0.16	A
Northbound Left-Turn	--	--	--	84.1	0.89	F	84.1	0.89	F
Northbound Right-Turn	--	--	--	10.6	0.12	B	10.6	0.12	B

Saturday Peak Hour	Base Year 2015			Base Year 2022			Base Year 2022 w/ Mit.		
Intersection/Movement	Delay	V/C	LOS	Delay	V/C	LOS	Delay	V/C	LOS
1 - Kamehameha Avenue & Maui Lani Parkway									
Eastbound Left-Turn	6.1	0.29	A	27.2	0.66	C	22.3	0.59	C
Eastbound Thru	8.3	0.21	A	27.9	0.48	C	24.5	0.45	C
Eastbound Right-Turn	7.4	0.02	A	24.4	0.16	C	21.6	0.16	C
Westbound Left-Turn	12.7	0.04	B	30.6	0.08	C	28.0	0.08	C
Westbound Thru	15.0	0.35	B	42.0	0.69	D	37.4	0.65	D
Westbound Right-Turn	13.5	0.09	B	32.6	0.10	C	29.9	0.10	C
Northbound Left-Turn	16.1	0.12	B	27.8	0.64	C	18.2	0.33	B
Northbound Thru	--	--	--	--	--	--	37.9	0.82	D
Northbound Thru-Right	15.9	0.11	B	35.8	0.80	D	--	--	--
Northbound Right-Turn	--	--	--	--	--	--	21.8	0.02	C
Southbound Left-Turn	18.2	0.45	B	20.6	0.57	C	24.3	0.62	C
Southbound Thru	--	--	--	--	--	--	27.4	0.54	C
Southbound Thru-Right	17.2	0.33	B	39.6	0.87	D	--	--	--
Southbound Right	--	--	--	--	--	--	23.5	0.19	C
Overall Delay	13.3	0.37	B	33.0	0.79	C	28.0	0.71	C
2 - Road C & Road B									
Westbound Left-Turn	--	--	--	8.6	0.14	A	8.6	0.14	A
Northbound Left-Turn	--	--	--	57.7	0.76	F	57.7	0.76	F
Northbound Right-Turn	--	--	--	10.4	0.11	B	10.4	0.11	B



IV. FUTURE YEAR TRAFFIC ANALYSIS WITH THE PROJECT

A. Future Year 2015 – Phase 1

Project Trip Generation

The Institute of Transportation Engineers (ITE) publishes a book based on empirical data compiled from a body of more than 4,250 trip generation studies submitted by public agencies, developers, consulting firms, and associations. This publication, titled Trip Generation Manual, 9th Edition, provides trip rates and/or formulae based on graphs that correlate vehicular trips with independent variables. The independent variables can range from Dwelling Units (DU) for single-family attached homes to Gross Floor Area (GFA) for commercial or office development to Acres for recreational park spaces. These trip rates/formulae and their associated directional distributions were used to estimate the increase in the number of vehicular trips generated by the Project.

By year 2015, Phase 1 of the Project is scheduled to include four (4) little league baseball fields, four (4) softball fields, three (3) full-size soccer fields, one (1) baseball field, and approximately 600 parking stalls on 65 acres of park land. The most similar land uses from the Trip Generation Manual are the 'County Park' (LUC 412) and 'Soccer Complex' (LUC 488) due to the size of the Project and forecast travel demand.

The forecast trip generation for the 'County Park' portion of the development was determined by subtracting the land area used by the sports fields and the drainage retention area. The remaining park area was estimated to be 13 acres, which is forecast to generate two (2) PM peak hour trips and 29 Saturday peak hour trips. The 'Soccer Complex' portion of the development used the same 'Field' units as if all the sports (baseball/softball/soccer) fields were used for soccer, as the number of players and length of games are comparable. The 12 sports fields are forecast to generate approximately 213 PM peak hour trips and 369 Saturday peak hour trips.

The trip generation rates for the Project are shown in Table 3 and the trips generated are shown in Table 4.



Table 3:
Project Trip Generation Rates

Land Use	Independent Variable (X)	PM Peak Hour of Traffic		SAT Peak Hour of Traffic	
		Rate	% Entering	Rate	% Entering
County Park (ITE Land Use 412)	Acres	0.09	61%	2.21	57%
Soccer Complex (ITE Land Use 488)	Fields	17.7	67%	a.	48%

SF GFA = Square Feet of Gross Floor Area

T = Number of Trip Ends

X = Independent Variable

Source: Institute of Transportation Engineers, Trip Generation Handbook, 9th Edition

a. $T = 37.04(X) - 75.92$

Table 4:
Project Generated Traffic

Land Use Designation	Quantity	PM Peak Hour			SAT Peak Hour		
		Enter	Exit	Total	Enter	Exit	Total
County Park (412)	13 Acres	1	1	2	17	12	29
Soccer Complex (488)	12 Fields	143	70	213	177	192	369
TOTAL NEW TRIPS		144	71	215	194	204	398

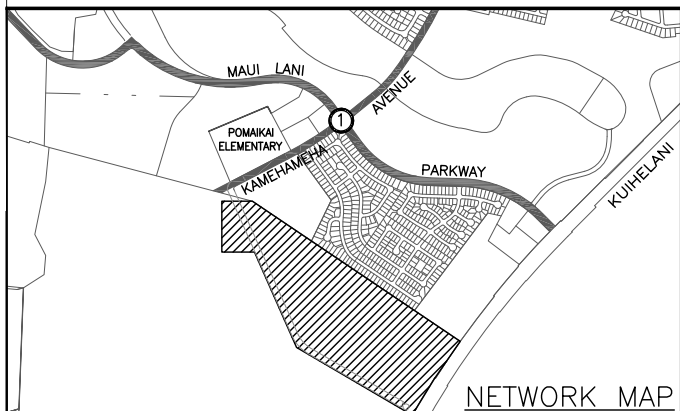
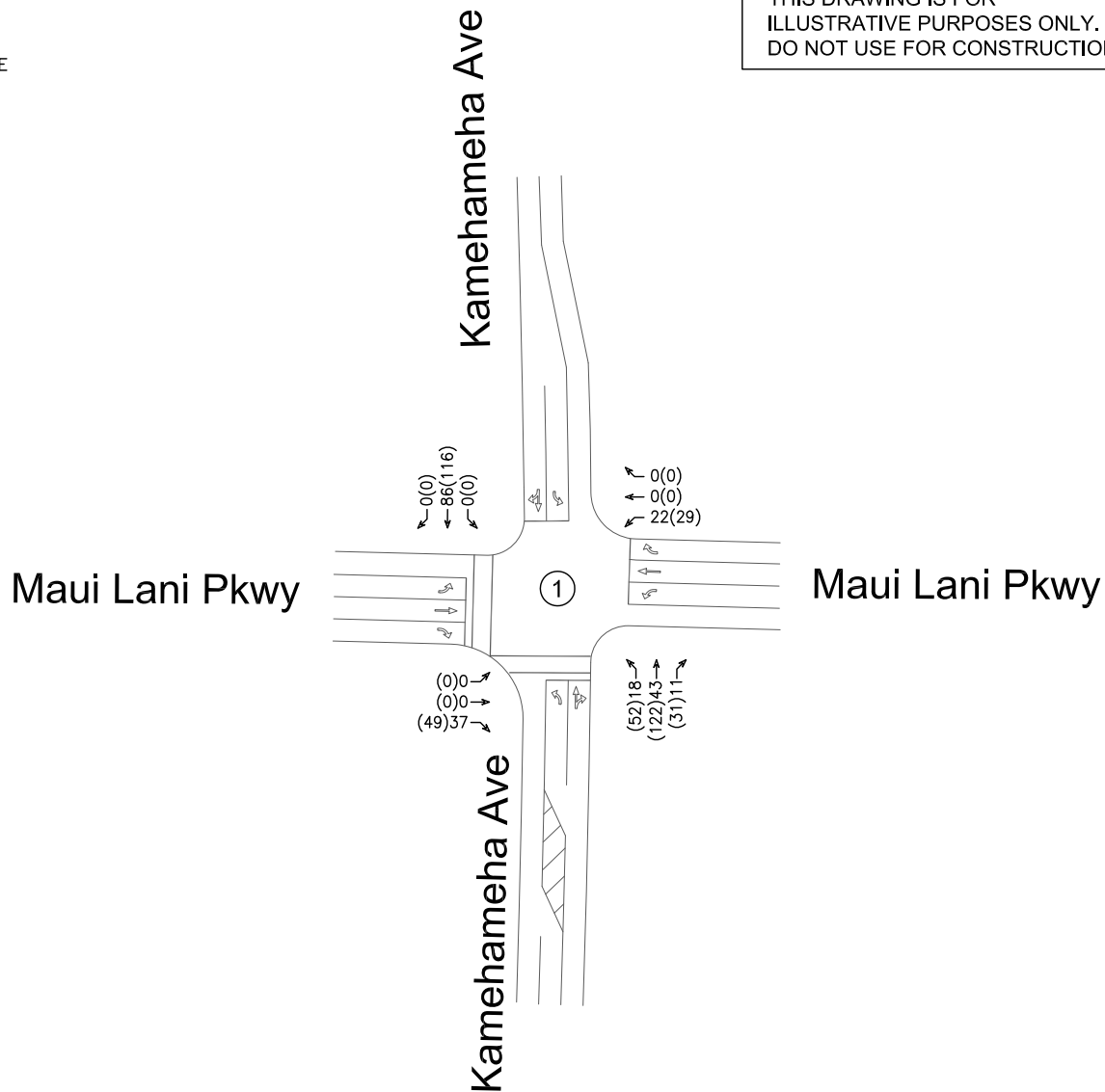
Trip Distribution/Assignment

Based on existing turning movements at the study intersection, it was assumed that most trips to and from the Project would begin within the Kahului and Wailuku areas. Project trips were distributed with approximately 60 percent to the north via Kamehameha Avenue, 25 percent to the west via Maui Lani Parkway and 15 percent to the east via Maui Lani Parkway. No pass-by or internal trip capture was assumed for the Project. Figure 7 illustrates the trip distribution for Phase 1 of the Project.



NOT TO SCALE

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LEGEND

- ##(##) - PM(SAT) PEAK HOUR OF TRAFFIC VOLUMES
- (Y) - INTERSECTION Y

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PHASE 1 PROJECT TRIP DISTRIBUTION

FIGURE

7



Future Year 2015 Analysis

A full access driveway will be provided on Kamehameha Avenue just south of Pomaikai Elementary School, hereinafter referred to as the 'West Access'. As a result, all vehicles traveling to and from the Project are forecast to utilize the study intersection during Phase 1.

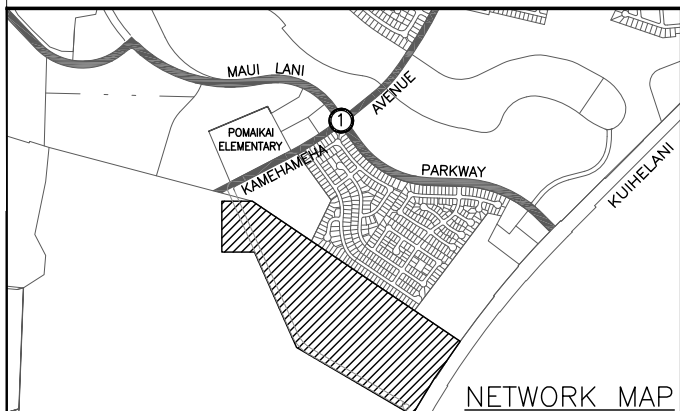
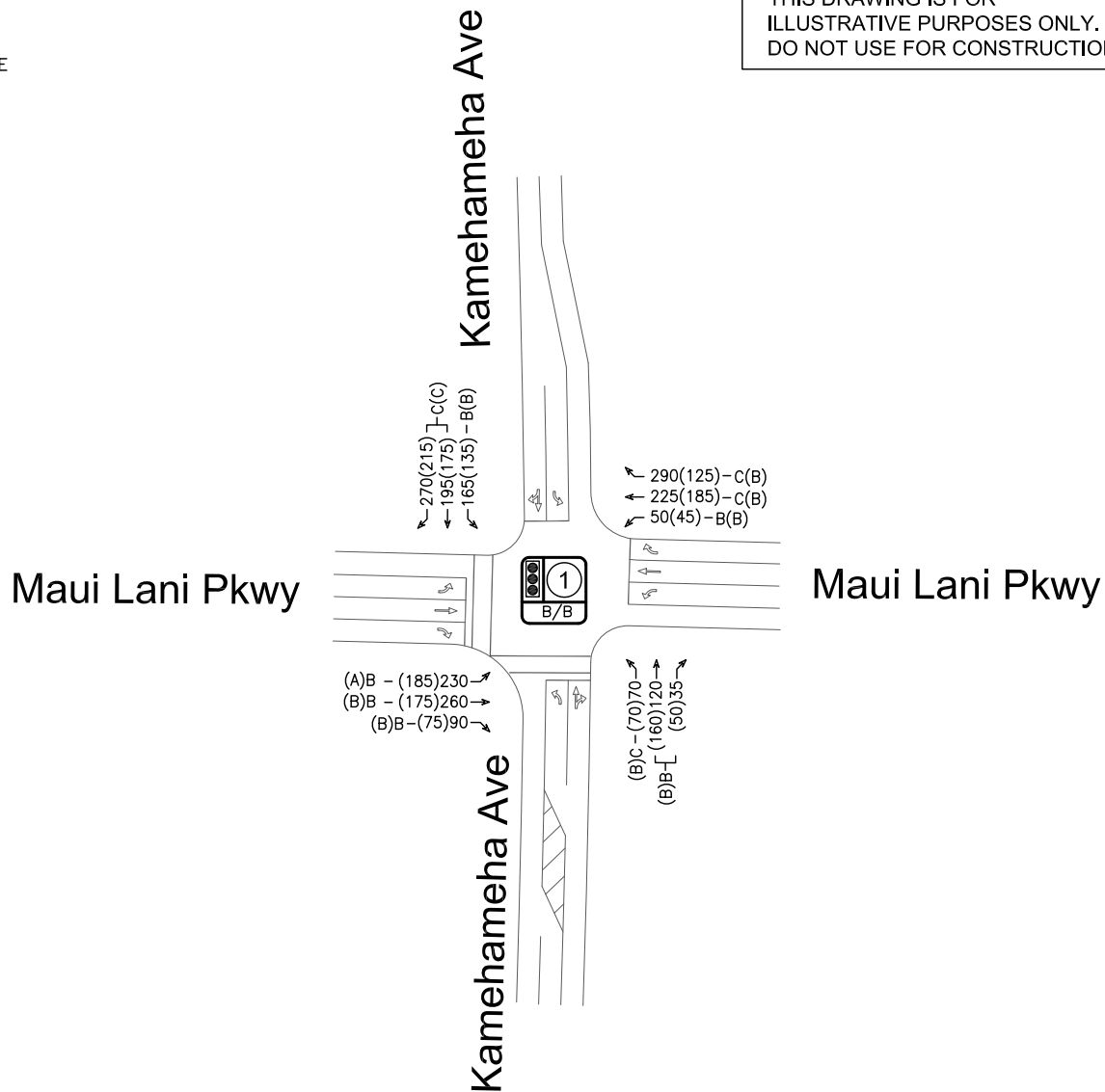
With Project generated traffic volumes, the study intersection operations are forecast to continue operating at overall LOS B during the PM and Saturday peak hours with all movements operating at LOS C or better.

Figure 8 illustrates the forecast traffic volumes, lane configuration, and LOS for Future 2015 – Phase 1 conditions. Table 5 summarizes the delay, V/C, and LOS at the study intersection for Base Year 2015 and Future 2015 – Phase 1 conditions.



NOT TO SCALE

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LEGEND

- ##(##) - PM(SAT) PEAK HOUR OF TRAFFIC VOLUMES
- X(X) - PM(SAT) LOS
- SIGNALIZED INTERSECTION Y, OVERALL PM/SAT LOS
- * - OVERCAPACITY, V/C >=1

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FUTURE YEAR 2015 - PHASE 1
LANE CONFIGURATION, TRAFFIC VOLUMES, AND LOS

FIGURE

8

Table 5: Base Year 2015 and Future Year 2015 LOS

PM Peak Hour	Base Year 2015			Future 2015		
Intersection/Movement	Delay	V/C	LOS	Delay	V/C	LOS
1 - Kamehameha Avenue & Maui Lani Parkway						
Eastbound Left-Turn	7.8	0.39	A	11.2	0.43	B
Eastbound Thru	11.0	0.34	B	15.4	0.38	B
Eastbound Right-Turn	9.3	0.03	A	13.1	0.06	B
Westbound Left-Turn	13.6	0.07	B	17.4	0.15	B
Westbound Thru	17.4	0.43	B	22.5	0.49	C
Westbound Right-Turn	15.8	0.20	B	20.2	0.20	C
Northbound Left-Turn	19.4	0.40	B	20.8	0.52	C
Northbound Thru-Right	16.5	0.18	B	16.1	0.24	B
Southbound Left-Turn	19.0	0.49	B	17.8	0.42	B
Southbound Thru-Right	22.0	0.64	C	24.2	0.73	C
Overall Delay	15.8	0.51	B	18.8	0.59	B

Saturday Peak Hour	Base Year 2015			Future 2015		
Intersection/Movement	Delay	V/C	LOS	Delay	V/C	LOS
1 - Kamehameha Avenue & Maui Lani Parkway						
Eastbound Left-Turn	6.1	0.29	A	8.6	0.32	A
Eastbound Thru	8.3	0.21	A	12.7	0.27	B
Eastbound Right-Turn	7.4	0.02	A	11.5	0.05	B
Westbound Left-Turn	12.7	0.04	B	14.3	0.12	B
Westbound Thru	15.0	0.35	B	18.5	0.41	B
Westbound Right-Turn	13.5	0.09	B	16.5	0.09	B
Northbound Left-Turn	16.1	0.12	B	17.4	0.43	B
Northbound Thru-Right	15.9	0.11	B	15.7	0.37	B
Southbound Left-Turn	18.2	0.45	B	16.6	0.43	B
Southbound Thru-Right	17.2	0.33	B	20.2	0.66	C
Overall Delay	13.3	0.37	B	15.7	0.50	B



B. Future Year 2022 – Phase 2

Uses of the Project are planned to be fully built and functional by year 2015. However, with the anticipated future construction of the Waiale Development to the south of the Project, alternate accesses would be provided. At the time of this writing it is uncertain when the Waiale Development would be completed, therefore, Year 2022 was selected as the build out year of that development to be consistent with the March 2011 Waiale Development TIAR. Furthermore, the Waiale Development is currently being revised and an update TIAR is planned as a result. Therefore, the revised TIAR may recommend different improvements at the intersections.

Project Trip Generation

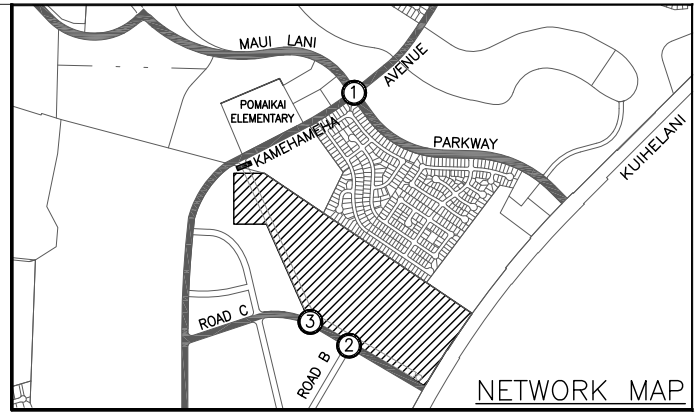
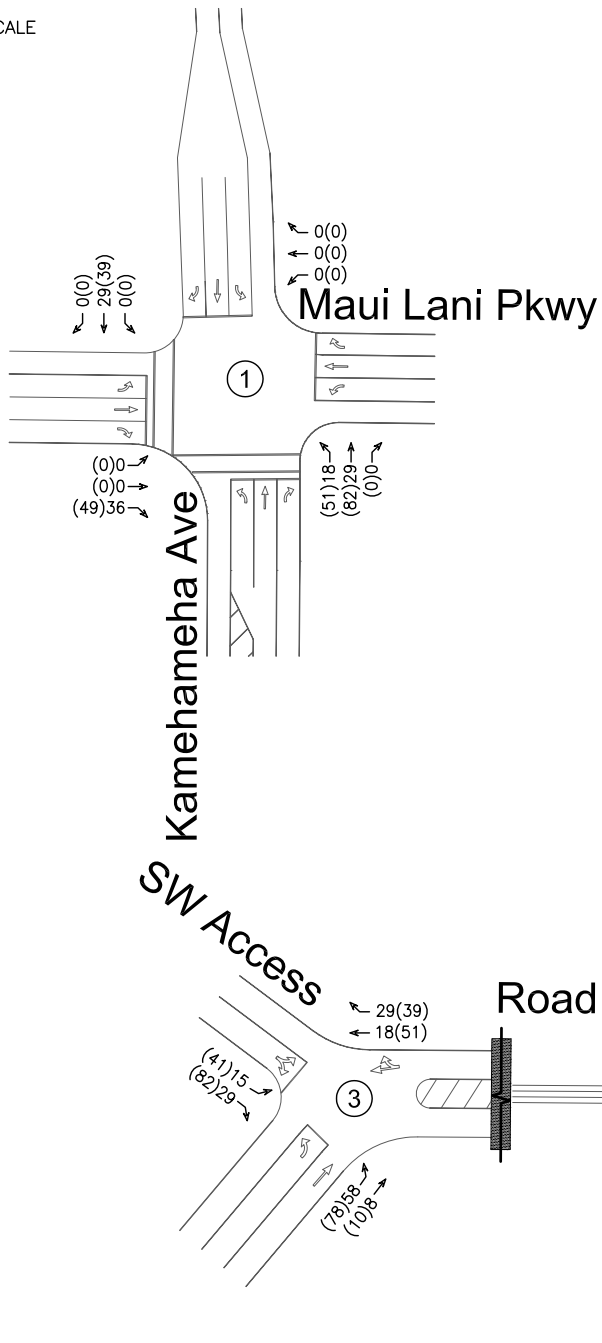
By year 2022, Phase 2 of the Project is scheduled to increase the size of the drainage retention area, provide two vehicle accesses along what is referred to as 'Road C', and restrict the vehicle access off of South Kamehameha Avenue to maintenance and emergency vehicles only. Phase 2 is not anticipated to increase the overall Project trip generation as described in Section IV.A.

Trip Distribution/Assignment

Two (2) vehicle accesses will be provided along Road C to the south of the Project as part of the Waiale Development and Phase 2 of the Project. Both of the vehicle access driveways will provide full access. One (1) access driveway will serve as the north leg of the Road C/Road B intersection, hereinafter referred to as the 'South Access'. The other vehicle access driveway will be located approximately 500 feet to the west of the Road C/Road B intersection, hereinafter referred to as the 'SW Access'. Figure 9 illustrates the trip distribution for Phase 2 of the Project.



NOT TO SCALE



LEGEND

##(##) - PM(SAT) PEAK HOUR OF TRAFFIC VOLUMES

Y - INTERSECTION Y

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PHASE 2 PROJECT TRIP DISTRIBUTION

FIGURE

9

Future Year 2022 Analysis

Kamehameha Avenue & Maui Lani Parkway

With Project generated traffic volumes and the improvements listed in Section III.C, the Kamehameha Avenue/Maui Lani Parkway intersection is forecast to operate at LOS C during the PM and Saturday peak hours, with all movements operating at LOS D or better.

Road C & Road B/South Access

The South Access will serve as the north leg of the Road C/Road B two-way stop-control intersection. Eastbound and westbound movements will operate freely, with an exclusive left-turn lane and a through-right lane on each approach. The northbound left-turn movement is forecast to operate at LOS F and exceed capacity during PM and Saturday peak hours, while the southbound left-turn movement will operate at LOS E during the PM peak hour and LOS F during the Saturday peak hour. All other movements are forecast to operate at LOS C or better. As discussed in Section III.C, it is recommended that the intersection be monitored after construction to determine when and if the intersection meets traffic signal warrants.

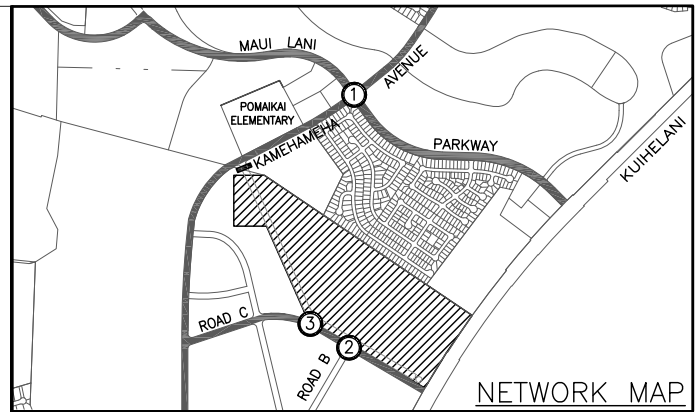
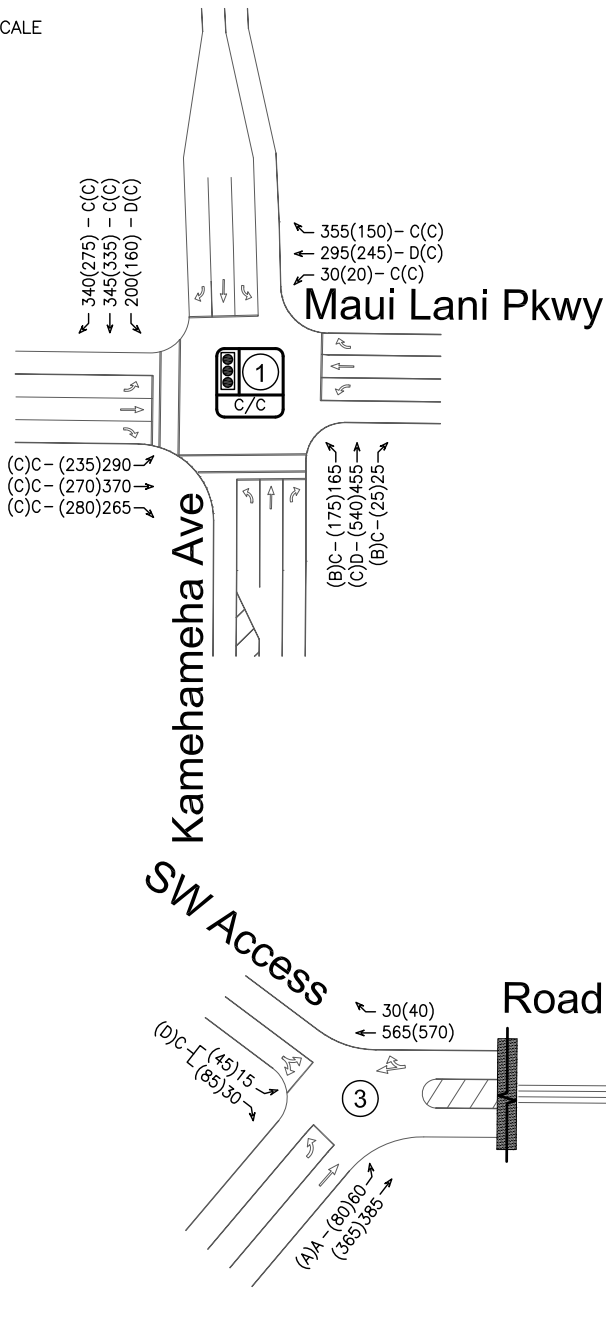
Road C & SW Access

All movements at this intersection are forecast to operate at LOS D or better during the PM and Saturday peak hours.

Figure 10 illustrates the forecast traffic volumes, lane configuration, and LOS for Future 2022 – Phase 2 conditions. Table 6 summarizes the delay, V/C, and LOS at the study intersection for Base Year 2022 with Mitigation and Future Year 2022 – Phase 2 conditions.



NOT TO SCALE



LEGEND

##(##) - PM(SAT) PEAK HOUR OF TRAFFIC VOLUMES

Y - INTERSECTION Y

X(X) - PM(SAT) LOS

 - SIGNALIZED INTERSECTION Y, OVERALL PM/SAT LOS

* - OVERCAPACITY, $V/C \geq 1$

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FUTURE YEAR 2022 - PHASE 2
TRAFFIC VOLUMES, LANE CONFIGURATION, AND LOS

FIGURE

10

Table 6: Base Year 2022 with Mitigation and Future Year 2022

Intersection/Movement	PM Peak Hour						Saturday Peak Hour					
	Base Year 2022 w/ Mit.			Future 2022			Base Year 2022 w/ Mit.			Future 2022		
	Delay	V/C	LOS	Delay	V/C	LOS	Delay	V/C	LOS	Delay	V/C	LOS
1 - Kamehameha Avenue & Maui Lani Parkway												
Eastbound Left-Turn	30.0	0.77	C	31.4	0.79	C	22.3	0.59	C	30.9	0.73	C
Eastbound Thru	28.1	0.59	C	28.4	0.61	C	24.5	0.45	C	27.1	0.52	C
Eastbound Right-Turn	22.3	0.16	C	22.7	0.19	C	21.6	0.16	C	23.7	0.19	C
Westbound Left-Turn	27.7	0.11	C	27.0	0.12	C	28.0	0.08	C	25.6	0.08	C
Westbound Thru	40.4	0.71	D	39.3	0.70	D	37.4	0.65	D	33.5	0.60	C
Westbound Right-Turn	32.4	0.33	C	32.1	0.36	C	29.9	0.10	C	27.5	0.10	C
Northbound Left-Turn	21.6	0.41	C	20.7	0.48	C	18.2	0.33	B	14.8	0.42	B
Northbound Thru	43.1	0.83	D	40.4	0.82	D	37.9	0.82	D	32.4	0.82	C
Northbound Right-Turn	25.2	0.02	C	23.3	0.02	C	21.8	0.02	C	17.4	0.02	B
Southbound Left-Turn	30.5	0.72	C	37.9	0.80	D	24.3	0.62	C	28.7	0.70	C
Southbound Thru	31.4	0.59	C	32.5	0.65	C	27.4	0.54	C	26.8	0.59	C
Southbound Right-Turn	26.4	0.23	C	26.1	0.23	C	23.5	0.19	C	22.0	0.19	C
Overall Delay	31.6	0.81	C	31.7	0.83	C	28.0	0.71	C	27.4	0.80	C
2 - Road C & Road B/South Access												
Eastbound Left-Turn	--	--	--	8.4	0.01	A	--	--	--	8.4	0.01	A
Westbound Left-Turn	8.7	0.16	A	8.8	0.16	A	8.6	0.14	A	8.8	0.15	A
Northbound Left-Turn	84.1	0.89	F	295.2	1.43	F*	57.7	0.76	F	367.9	1.58	F*
Northbound Thru-Right	10.6	0.12	B	14.3	0.21	B	10.4	0.11	B	14.4	0.20	B
Southbound Left-Turn	--	--	--	43.2	0.10	E	--	--	--	48.7	0.25	E
Southbound Thru-Right	--	--	--	15.8	0.08	C	--	--	--	17.8	0.21	C
3 - Road C & SW Access												
Eastbound Left-Turn	--	--	--	9.1	0.07	A	--	--	--	9.3	0.09	A
Southbound Left-Right	--	--	--	18.1	0.15	C	--	--	--	26.6	0.46	D

* Over capacity conditions.



V. CONCLUSION

The Project plans to provide approximately 65 acres of recreational park space on an undeveloped parcel fronting Kuihelani Highway with two (2) phases of development. The first phase of development will include four (4) little league baseball fields, four (4) softball fields, three (3) full-size soccer fields, one (1) baseball field, and a small drainage retention area with primary vehicle access via South Kamehameha Avenue. Phase 2 will increase the size of the drainage retention area, provide two (2) vehicle accesses along what is referred to as 'Road C', and restrict the vehicle access off of South Kamehameha Avenue to maintenance and emergency vehicles only.

The all-way stop-controlled Kamehameha Avenue/Maui Lani Parkway study intersection currently operates at LOS F with eastbound and westbound approaches experiencing average vehicle delays of one to two minutes during the PM peak hour. Intersection operations during the Saturday peak hour of traffic were observed to operate satisfactorily, with LOS C or better on all approaches. Based on existing traffic count data, a traffic signal at the study intersection is currently warranted.

Base Year 2015 and 2022 PM and Saturday peak hour traffic conditions were forecast using defacto growth rates for each movement based on the Maui Regional Long-Range Land Transportation Plan (MRTP) and other known developments. The study intersection is forecast to operate at LOS B for PM and Saturday peak hour conditions in 2015 and LOS C in 2022 with the proposed mitigation. The Road C/Road B intersection that will be constructed as part of the Waiale Development is forecast to operate at LOS B or better for all movements during the PM and Saturday peak hours except the northbound left-turn, which is forecast to operate at LOS F. Based upon forecast traffic volumes, a traffic signal may be warranted by 2022.

Future Year 2015, full construction of Project's uses – Phase 1 traffic conditions were forecast by combining Project generated traffic with Base Year 2015 traffic. The study intersection is forecast to continue operating at LOS B during the PM and Saturday peak hours, with all movements operating at LOS C.

Future Year 2022, increase of Project's drainage retention area, no increase in Project traffic – Phase 2 traffic conditions were forecast by combining Project generated traffic with Base Year 2022 traffic. The study intersection is forecast to operate at LOS C during PM and Saturday peak hours with the proposed mitigation. The



Road C/Road B/South Access intersection is forecast to operate at LOS C or better for all movements during the PM and Saturday peak hours except for the northbound left-turn, which is forecast to operate at over capacity with LOS F, and the southbound left-turn, which is forecast to operate at LOS E during the PM peak hour and LOS F during the Saturday peak hour. The SW Access is forecast to operate at LOS D or better for all movements during the PM and Saturday peak hours of traffic. Note that without the Waiale Development, the Project access would remain along Kamehameha Avenue similar to Phase 1.

VI. RECOMMENDATIONS

Base Year 2015 conditions without the Project:

Kamehameha Avenue/Maui Lani Parkway:

- Provide exclusive left-turn and right-turn lanes along Maui Lani Parkway.
- Install a traffic signal at the Kamehameha Avenue/Maui Lani Parkway intersection.

Base Year 2022 conditions without the Project:

Kamehameha Avenue/Maui Lani Parkway:

- Construct exclusive northbound and southbound right-turn lanes at the Kamehameha Avenue/Maui Lani Parkway intersection.
- Monitor the Road C/Road B intersection after construction. Consider installing a traffic control signal at the Road C/Road B intersection when and if appropriate warrants are met.

Future Year 2022 conditions with the Project:

Road C/Road B/South Access – stop controlled on the northbound and southbound approaches:

- All approaches: provide a left-turn lane and a shared through/right-turn lane.
- Monitor the Road C/Road B intersection after construction. Consider installing a traffic control signal at the Road C/Road B intersection when and if appropriate warrants are met.



Road C/SW Access – stop controlled on the southbound approach:

- Eastbound approach: provide a left-turn lane and a through lane.
- Westbound approach: provide a shared through/right-turn lane.
- Southbound approach: provide a shared left-turn/right-turn lane.



VII. REFERENCES

1. Transportation Research Board, Highway Capacity Manual, 2000.
2. Federal Highway Administration, Manual on Uniform Traffic Control Devices, 2009.
3. Austin, Tsutsumi, & Associates, Waiale Development TIAR, 2011.
4. Institute of Transportation Engineers, Trip Generation, 9th Edition, 2012.
5. American Association of State Highway and Transportation Officials, A Policy on Geometric Design of Highways and Streets, 2011.



APPENDICES



APPENDIX A

TRAFFIC COUNT DATA

Austin Tsutsumi & Associates

501 Sumner St. Ste. 521

Honolulu, HI 96817

(808) 533-3646

File Name : AM_Kamehameha - Maui Lani

Site Code : 00000000

Start Date : 12/5/2012

Page No : 1

Groups Printed- Unshifted

	KAMEHAMEHA From North					MAUI LANI From East					KAMEHAMEHA From South					MAUI LANI From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
06:30 AM	30	8	52	0	90	22	33	9	0	64	3	13	7	0	23	2	40	25	1	68	245
06:45 AM	31	16	52	0	99	30	41	13	0	84	4	7	6	3	20	8	44	38	1	91	294
Total	61	24	104	0	189	52	74	22	0	148	7	20	13	3	43	10	84	63	2	159	539
07:00 AM	43	50	51	0	144	20	28	13	0	61	16	31	19	2	68	24	36	45	6	111	384
07:15 AM	45	51	48	0	144	26	34	19	1	80	27	49	34	1	111	43	21	34	2	100	435
07:30 AM	32	52	33	0	117	25	40	21	0	86	36	65	51	0	152	44	25	24	11	104	459
07:45 AM	59	28	43	0	130	24	57	4	0	85	30	57	57	1	145	14	46	26	1	87	447
Total	179	181	175	0	535	95	159	57	1	312	109	202	161	4	476	125	128	129	20	402	1725
08:00 AM	23	10	38	0	71	22	38	3	0	63	6	22	8	1	37	7	50	26	0	83	254
08:15 AM	22	9	39	0	70	18	34	1	0	53	3	6	8	0	17	3	56	49	1	109	249
Grand Total	285	224	356	0	865	187	305	83	1	576	125	250	190	8	573	145	318	267	23	753	2767
Apprch %	32.9	25.9	41.2	0		32.5	53	14.4	0.2		21.8	43.6	33.2	1.4		19.3	42.2	35.5	3.1		
Total %	10.3	8.1	12.9	0	31.3	6.8	11	3	0	20.8	4.5	9	6.9	0.3	20.7	5.2	11.5	9.6	0.8	27.2	

Austin Tsutsumi & Associates

501 Sumner St. Ste. 521

Honolulu, HI 96817

(808) 533-3646

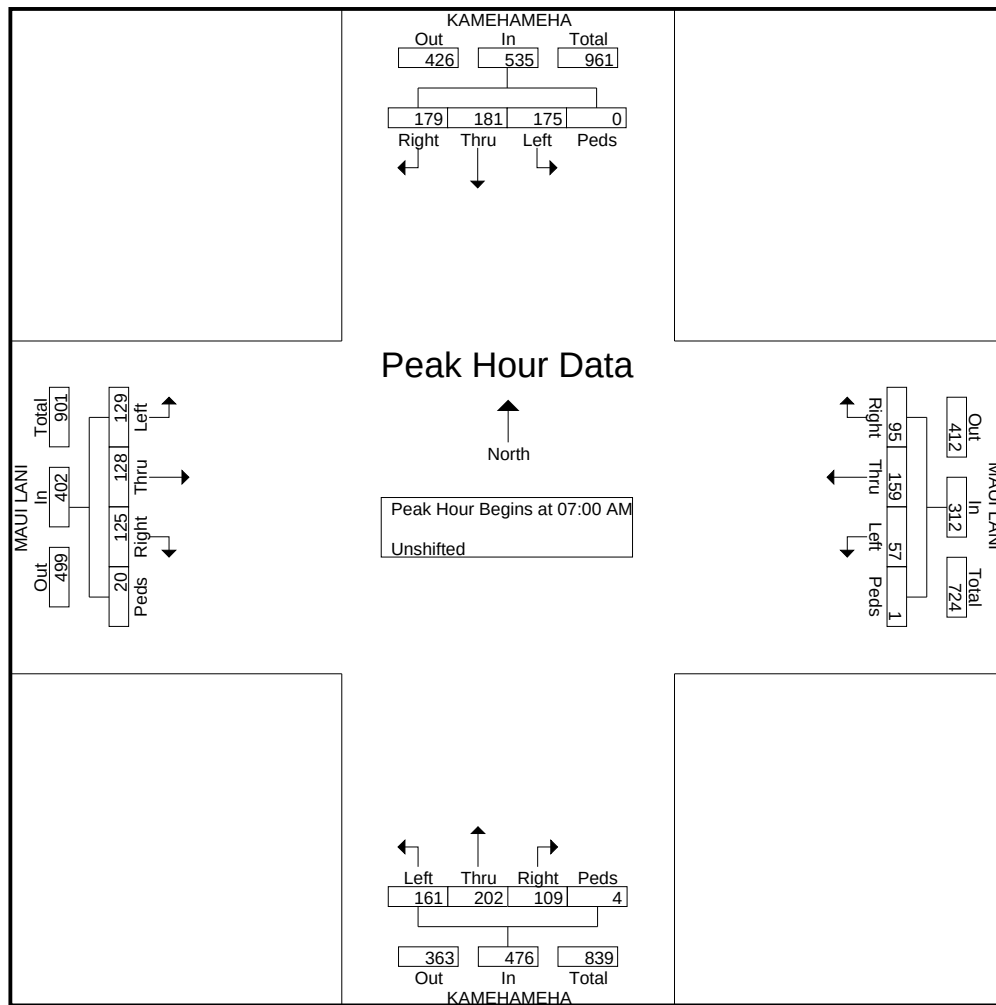
File Name : AM_Kamehameha - Maui Lani

Site Code : 00000000

Start Date : 12/5/2012

Page No : 2

	KAMEHAMEHA From North					MAUI LANI From East					KAMEHAMEHA From South					MAUI LANI From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 06:30 AM to 08:15 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:00 AM																					
07:00 AM	43	50	51	0	144	20	28	13	0	61	16	31	19	2	68	24	36	45	6	111	384
07:15 AM	45	51	48	0	144	26	34	19	1	80	27	49	34	1	111	43	21	34	2	100	435
07:30 AM	32	52	33	0	117	25	40	21	0	86	36	65	51	0	152	44	25	24	11	104	459
07:45 AM	59	28	43	0	130	24	57	4	0	85	30	57	57	1	145	14	46	26	1	87	447
Total Volume	179	181	175	0	535	95	159	57	1	312	109	202	161	4	476	125	128	129	20	402	1725
% App. Total	33.5	33.8	32.7	0		30.4	51	18.3	0.3		22.9	42.4	33.8	0.8		31.1	31.8	32.1	5		
PHF	.758	.870	.858	.000	.929	.913	.697	.679	.250	.907	.757	.777	.706	.500	.783	.710	.696	.717	.455	.905	.940



Your Company Name Here

This is your address
Your City, State, Zip Code

Your Tagline Here

File Name : PM_Kamehameha - Maui Lani

Site Code : 00000000

Start Date : 12/4/2012

Page No : 1

Groups Printed- Unshifted

	KAMEHAMEHA From North					MAUI LANI From East					KAMEHAMEHA From South					MAUI LANI From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
01:30 PM	36	24	21	1	82	28	36	7	0	71	3	9	5	0	17	13	40	34	0	87	257
01:45 PM	41	38	17	1	97	28	45	14	0	87	8	8	5	0	21	33	33	38	1	105	310
Total	77	62	38	2	179	56	81	21	0	158	11	17	10	0	38	46	73	72	1	192	567
02:00 PM	45	38	25	0	108	31	42	10	0	83	12	54	33	0	99	18	32	29	17	96	386
02:15 PM	62	29	32	2	125	25	61	5	0	91	20	51	44	1	116	7	38	40	9	94	426
02:30 PM	46	12	23	0	81	59	52	4	0	115	6	19	10	0	35	9	43	37	2	91	322
02:45 PM	50	17	33	0	100	38	52	5	0	95	7	15	5	0	27	8	46	39	0	93	315
Total	203	96	113	2	414	153	207	24	0	384	45	139	92	1	277	42	159	145	28	374	1449
03:00 PM	53	11	41	0	105	45	56	7	0	108	8	11	8	0	27	9	42	50	0	101	341
03:15 PM	68	19	23	0	110	45	53	11	0	109	13	23	10	0	46	12	47	33	1	93	358
03:30 PM	74	21	43	0	138	52	48	5	0	105	20	31	17	2	70	10	46	50	0	106	419
03:45 PM	47	12	29	0	88	62	52	10	0	124	8	20	12	3	43	6	59	67	1	133	388
Total	242	63	136	0	441	204	209	33	0	446	49	85	47	5	186	37	194	200	2	433	1506
04:00 PM	53	26	34	0	113	62	47	7	0	116	5	17	14	1	37	10	54	57	1	122	388
04:15 PM	53	28	36	0	117	61	54	2	1	118	5	22	11	0	38	12	57	45	0	114	387
04:30 PM	68	23	43	0	134	69	48	7	0	124	6	13	11	0	30	9	55	55	1	120	408
04:45 PM	64	25	40	0	129	74	47	6	0	127	3	16	7	1	27	13	63	50	1	127	410
Total	238	102	153	0	493	266	196	22	1	485	19	68	43	2	132	44	229	207	3	483	1593
05:00 PM	73	26	39	0	138	56	44	3	0	103	10	14	13	1	38	8	57	59	3	127	406
05:15 PM	68	16	39	0	123	73	44	9	0	126	2	12	6	1	21	8	54	60	0	122	392
Grand Total	901	365	518	4	1788	808	781	112	1	1702	136	335	211	10	692	185	766	743	37	1731	5913
Apprch %	50.4	20.4	29	0.2		47.5	45.9	6.6	0.1		19.7	48.4	30.5	1.4		10.7	44.3	42.9	2.1		
Total %	15.2	6.2	8.8	0.1	30.2	13.7	13.2	1.9	0	28.8	2.3	5.7	3.6	0.2	11.7	3.1	13	12.6	0.6	29.3	

Your Company Name Here

This is your address
Your City, State, Zip Code

Your Tagline Here

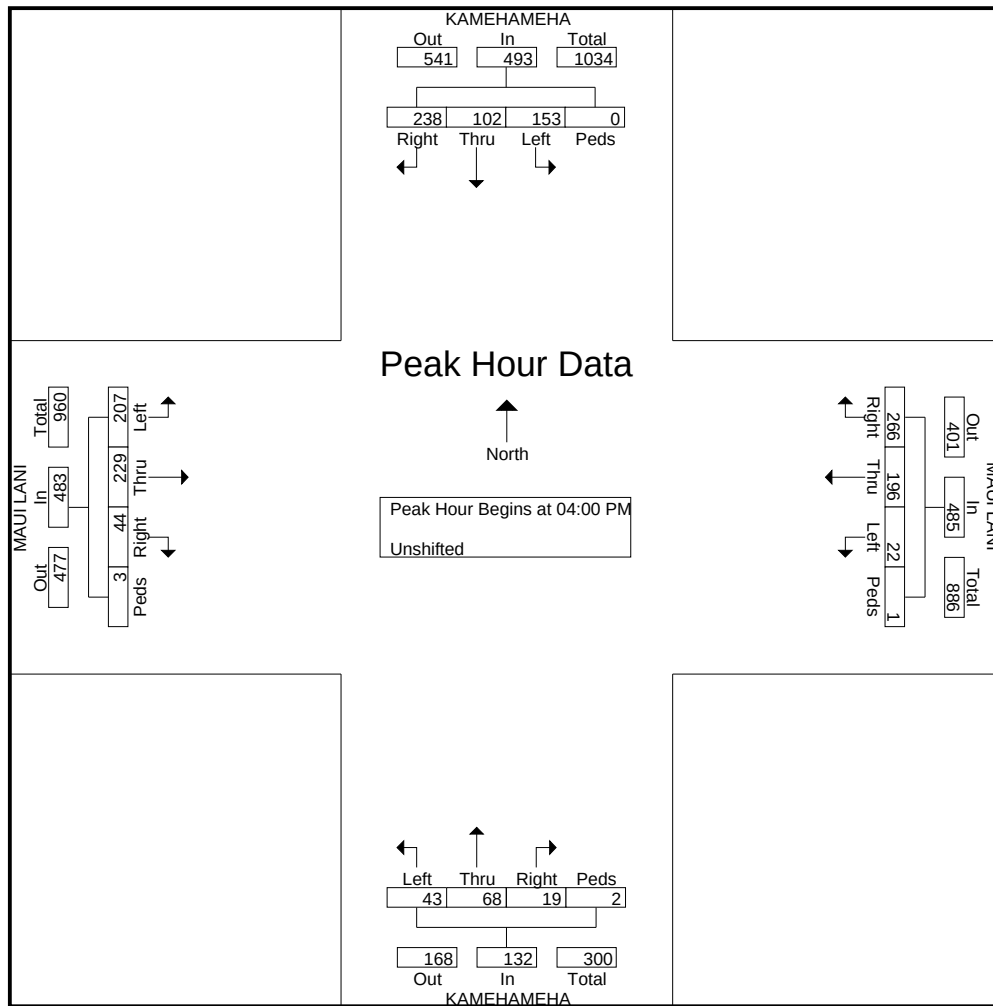
File Name : PM_Kamehameha - Maui Lani

Site Code : 00000000

Start Date : 12/4/2012

Page No : 2

	KAMEHAMEHA From North					MAUI LANI From East					KAMEHAMEHA From South					MAUI LANI From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 04:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 04:00 PM																					
04:00 PM	53	26	34	0	113	62	47	7	0	116	5	17	14	1	37	10	54	57	1	122	388
04:15 PM	53	28	36	0	117	61	54	2	1	118	5	22	11	0	38	12	57	45	0	114	387
04:30 PM	68	23	43	0	134	69	48	7	0	124	6	13	11	0	30	9	55	55	1	120	408
04:45 PM	64	25	40	0	129	74	47	6	0	127	3	16	7	1	27	13	63	50	1	127	410
Total Volume	238	102	153	0	493	266	196	22	1	485	19	68	43	2	132	44	229	207	3	483	1593
% App. Total	48.3	20.7	31	0		54.8	40.4	4.5	0.2		14.4	51.5	32.6	1.5		9.1	47.4	42.9	0.6		
PHF	.875	.911	.890	.000	.920	.899	.907	.786	.250	.955	.792	.773	.768	.500	.868	.846	.909	.908	.750	.951	.971



501 Sumner Street Suite 521
Honolulu, HI, Zip 96817

Groups Printed- Unshifted - Bank 1

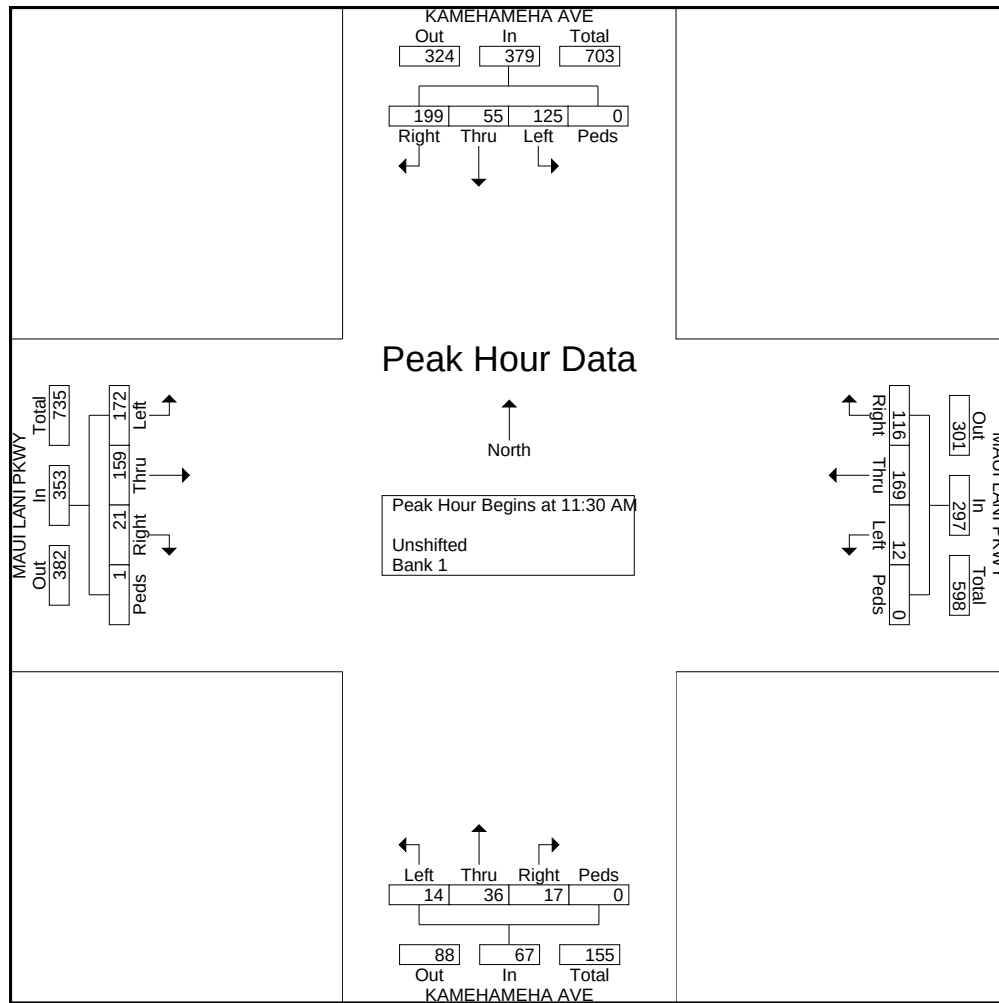
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Austin, Tsutsumi & Associates

501 Sumner Street Suite 521
Honolulu, HI, Zip 96817

File Name : WE_Maui Lani - Kamehameha
Site Code : 00000000
Start Date : 4/6/2013
Page No : 2

	KAMEHAMEHA AVE From North					MAUI LANI PKWY From East					KAMEHAMEHA AVE From South					MAUI LANI PKWY From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 11:30 AM to 12:15 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 11:30 AM																					
11:30 AM	49	12	28	0	89	23	37	1	0	61	5	7	6	0	18	3	42	34	1		
11:45 AM	59	13	27	0	99	29	44	2	0	75	2	9	3	0	14	3	38	48	0	89	277
12:00 PM	50	13	29	0	92	26	40	6				13			20	7	36	41	0	84	268
12:15 PM	41	17	41			38	48			89	6					8	43	49		100	303
Total Volume	199	55	125	0	379	116	169	12	0	297	17	36	14	0	67	21	159	172	1	353	1096
% App. Total	52.5	14.5	33	0		39.1	56.9	4	0		25.4	53.7	20.9	0		5.9	45	48.7	0.3		
PHF	.843	.809	.762	.000	.957	.763	.880	.500	.000	.834	.708	.692	.583	.000	.838	.656	.924	.878	.250	.883	.904





APPENDIX B

LEVEL OF SERVICE CRITERIA

APPENDIX B – LEVEL OF SERVICE (LOS) CRITERIA

LEVEL OF SERVICE FOR SIGNALIZED INTERSECTIONS (HCM 2000)

Level of service for signalized intersections is directly related to delay values and is assigned on that basis. Level of Service is a measure of the acceptability of delay values to motorists at a given intersection. The criteria are given in table below.

Level-of Service Criteria for Signalized Intersections

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

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

LEVEL OF SERVICE CRITERIA FOR UNSIGNALIZED INTERSECTIONS (HCM 2000)

The level of service criteria for unsignalized intersections is defined as the average total delay, in seconds per vehicle. LOS delay threshold values are lower for two-way stop-controlled (TWSC) and all-way stop-controlled (AWSC) intersections than those of signalized intersections. This is because more vehicles pass through signalized intersections, and therefore, drivers expect and tolerate greater delays.

Level of Service Criteria for Two-Way Stop-Controlled Intersections

Level of Service	Average Total Delay (sec/veh)
A	≤ 10
B	>10 and ≤15
C	>15 and ≤25
D	>25 and ≤35
E	>35 and ≤50
F	> 50

Analyses for study intersections are performed using the traffic analysis software Synchro, which is able to prepare reports based on the methodologies described in the HCM. These reports contain control delay results as based on intersection lane geometry, signal timing, and hourly traffic volumes. Based on the vehicular delay at each intersection, a LOS is assigned to each approach and intersection movement as a qualitative measure of performance. These results, as confirmed or refined by field observations, constitute the technical analysis that form the basis of the recommendations outlined in this report.



APPENDIX C

LEVEL OF SERVICE CALCULATIONS



APPENDIX C

LEVEL OF SERVICE CALCULATIONS

- Existing PM Peak
-

HCM Unsignalized Intersection Capacity Analysis

1: Kamehameha Ave & Maui Lani Pkwy

Central Maui Regional Park

8/6/2013

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	207	229	44	22	196	266	43	68	19	153	102	238
Peak Hour Factor	0.91	0.91	0.85	0.79	0.91	0.90	0.77	0.77	0.79	0.89	0.91	0.88
Hourly flow rate (vph)	227	252	52	28	215	296	56	88	24	172	112	270
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2						
Volume Total (vph)	531	539	56	112	172	383						
Volume Left (vph)	227	28	56	0	172	0						
Volume Right (vph)	52	296	0	24	0	270						
Hadj (s)	0.06	-0.28	0.53	-0.12	0.53	-0.46						
Departure Headway (s)	7.7	7.4	9.9	9.3	8.9	7.9						
Degree Utilization, x	1.14	1.11	0.15	0.29	0.43	0.84						
Capacity (veh/h)	472	499	353	377	397	449						
Control Delay (s)	113.6	100.3	13.5	14.9	17.2	39.6						
Approach Delay (s)	113.6	100.3	14.4		32.6							
Approach LOS	F	F	B		D							
Intersection Summary												
Delay			75.3									
Level of Service			F									
Intersection Capacity Utilization			90.9%	ICU Level of Service				E				
Analysis Period (min)			15									



APPENDIX C

LEVEL OF SERVICE CALCULATIONS

- Existing Saturday Peak
-

HCM Unsignalized Intersection Capacity Analysis

1: Kamehameha Ave & Maui Lani Pkwy

Central Maui Regional Park

8/6/2013

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	172	159	21	12	169	116	14	36	17	125	55	199
Peak Hour Factor	0.88	0.92	0.66	0.50	0.88	0.76	0.58	0.69	0.71	0.76	0.81	0.84
Hourly flow rate (vph)	195	173	32	24	192	153	24	52	24	164	68	237
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2						
Volume Total (vph)	400	369	24	76	164	305						
Volume Left (vph)	195	24	24	0	164	0						
Volume Right (vph)	32	153	0	24	0	237						
Hadj (s)	0.08	-0.20	0.53	-0.19	0.53	-0.51						
Departure Headway (s)	6.5	6.3	8.6	7.9	7.7	6.7						
Degree Utilization, x	0.72	0.64	0.06	0.17	0.35	0.56						
Capacity (veh/h)	530	540	367	396	441	506						
Control Delay (s)	24.2	19.9	10.9	11.2	13.7	16.8						
Approach Delay (s)	24.2	19.9	11.2		15.7							
Approach LOS	C	C	B		C							
Intersection Summary												
Delay			19.0									
Level of Service			C									
Intersection Capacity Utilization			61.0%	ICU Level of Service		B						
Analysis Period (min)			15									



APPENDIX C

LEVEL OF SERVICE CALCULATIONS

- Base Year 2015 PM Peak
-

HCM Signalized Intersection Capacity Analysis

1: Kamehameha Avenue & Maui Lani Parkway

Central Maui Regional Park

8/26/2013

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	230	260	50	25	225	290	50	75	25	165	110	270
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	6.0	6.0	4.0	6.0	6.0	4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1863	1583	1770	1863	1583	1770	1794		1770	1665	
Flt Permitted	0.48	1.00	1.00	0.59	1.00	1.00	0.25	1.00		0.69	1.00	
Satd. Flow (perm)	898	1863	1583	1092	1863	1583	472	1794		1279	1665	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	250	283	54	27	245	315	54	82	27	179	120	293
RTOR Reduction (vph)	0	0	30	0	0	219	0	14	0	0	106	0
Lane Group Flow (vph)	250	283	24	27	245	96	54	95	0	179	307	0
Turn Type	pm+pt	NA	Perm	pm+pt	NA	Perm	Perm	NA		Perm	NA	
Protected Phases	7	4		3	8			2			6	
Permitted Phases	4		4	8		8	2			6		
Actuated Green, G (s)	33.4	27.5	27.5	20.5	18.6	18.6	17.4	17.4		17.4	17.4	
Effective Green, g (s)	33.4	27.5	27.5	20.5	18.6	18.6	17.4	17.4		17.4	17.4	
Actuated g/C Ratio	0.55	0.45	0.45	0.34	0.31	0.31	0.29	0.29		0.29	0.29	
Clearance Time (s)	4.0	6.0	6.0	4.0	6.0	6.0	4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	648	842	715	389	569	484	135	513		366	476	
v/s Ratio Prot	c0.07	0.15		0.00	0.13			0.05			c0.18	
v/s Ratio Perm	c0.14		0.02	0.02		0.06	0.11			0.14		
v/c Ratio	0.39	0.34	0.03	0.07	0.43	0.20	0.40	0.18		0.49	0.64	
Uniform Delay, d1	7.4	10.8	9.3	13.6	16.9	15.6	17.5	16.4		18.0	19.0	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.4	0.2	0.0	0.1	0.5	0.2	1.9	0.2		1.0	3.0	
Delay (s)	7.8	11.0	9.3	13.6	17.4	15.8	19.4	16.5		19.0	22.0	
Level of Service	A	B	A	B	B	B	B	B		B	C	
Approach Delay (s)		9.5			16.4			17.5			21.1	
Approach LOS		A			B			B			C	
Intersection Summary												
HCM 2000 Control Delay			15.8			HCM 2000 Level of Service				B		
HCM 2000 Volume to Capacity ratio			0.51									
Actuated Cycle Length (s)			60.8			Sum of lost time (s)			14.0			
Intersection Capacity Utilization			65.3%			ICU Level of Service			C			
Analysis Period (min)			15									
c Critical Lane Group												

Timing Report, Sorted By Phase
1: Kamehameha Avenue & Maui Lani Parkway

Central Maui Regional Park

8/26/2013

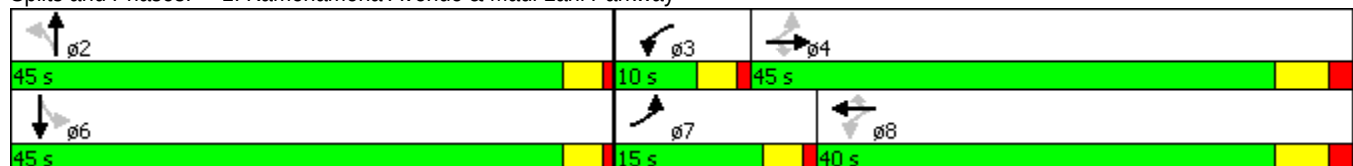


Phase Number	2	3	4	6	7	8
Movement	NBTL	WBL	EBTL	SBTL	EBL	WBTL
Lead/Lag		Lead	Lag		Lead	Lag
Lead-Lag Optimize		Yes	Yes		Yes	Yes
Recall Mode	None	None	Min	None	None	Min
Maximum Split (s)	45	10	45	45	15	40
Maximum Split (%)	45.0%	10.0%	45.0%	45.0%	15.0%	40.0%
Minimum Split (s)	38	10	35	38	10	35
Yellow Time (s)	3	3	4	3	3	4
All-Red Time (s)	1	1	2	1	1	2
Minimum Initial (s)	4	4	4	4	4	4
Vehicle Extension (s)	3	3	3	3	3	3
Minimum Gap (s)	3	3	3	3	3	3
Time Before Reduce (s)	0	0	0	0	0	0
Time To Reduce (s)	0	0	0	0	0	0
Walk Time (s)	7		7	7		7
Flash Dont Walk (s)	25		22	25		22
Dual Entry	Yes	No	Yes	Yes	No	Yes
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	45	55	0	45	60
End Time (s)	45	55	0	45	60	0
Yield/Force Off (s)	41	51	94	41	56	94
Yield/Force Off 170(s)	16	51	94	16	56	94
Local Start Time (s)	0	45	55	0	45	60
Local Yield (s)	41	51	94	41	56	94
Local Yield 170(s)	16	51	94	16	56	94

Intersection Summary

Cycle Length	100
Control Type	Actuated-Uncoordinated
Natural Cycle	85

Splits and Phases: 1: Kamehameha Avenue & Maui Lani Parkway





APPENDIX C

LEVEL OF SERVICE CALCULATIONS

- Base Year 2015 Saturday Peak
-

HCM Signalized Intersection Capacity Analysis

1: Kamehameha Avenue & Maui Lani Parkway

Central Maui Regional Park

8/26/2013

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	185	175	25	15	185	125	20	40	20	135	60	215
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	6.0	6.0	4.0	6.0	6.0	4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Flt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.95		1.00	0.88	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1863	1583	1770	1863	1583	1770	1768		1770	1644	
Flt Permitted	0.51	1.00	1.00	0.64	1.00	1.00	0.40	1.00		0.71	1.00	
Satd. Flow (perm)	949	1863	1583	1188	1863	1583	745	1768		1331	1644	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	201	190	27	16	201	136	22	43	22	147	65	234
RTOR Reduction (vph)	0	0	14	0	0	94	0	17	0	0	165	0
Lane Group Flow (vph)	201	190	13	16	201	42	22	48	0	147	134	0
Turn Type	pm+pt	NA	Perm	pm+pt	NA	Perm	Perm	NA		Perm	NA	
Protected Phases	7	4		3	8			2			6	
Permitted Phases	4		4	8		8	2			6		
Actuated Green, G (s)	30.9	26.2	26.2	17.4	16.7	16.7	13.5	13.5		13.5	13.5	
Effective Green, g (s)	30.9	26.2	26.2	17.4	16.7	16.7	13.5	13.5		13.5	13.5	
Actuated g/C Ratio	0.57	0.48	0.48	0.32	0.31	0.31	0.25	0.25		0.25	0.25	
Clearance Time (s)	4.0	6.0	6.0	4.0	6.0	6.0	4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	692	897	762	387	571	485	184	438		330	407	
v/s Ratio Prot	c0.05	0.10		0.00	c0.11			0.03			0.08	
v/s Ratio Perm	0.11		0.01	0.01		0.03	0.03			c0.11		
v/c Ratio	0.29	0.21	0.02	0.04	0.35	0.09	0.12	0.11		0.45	0.33	
Uniform Delay, d1	5.9	8.1	7.4	12.7	14.6	13.4	15.8	15.8		17.3	16.7	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.2	0.1	0.0	0.0	0.4	0.1	0.3	0.1		1.0	0.5	
Delay (s)	6.1	8.3	7.4	12.7	15.0	13.5	16.1	15.9		18.2	17.2	
Level of Service	A	A	A	B	B	B	B	B		B	B	
Approach Delay (s)		7.2			14.3			16.0			17.6	
Approach LOS		A			B			B			B	
Intersection Summary												
HCM 2000 Control Delay			13.3									
HCM 2000 Volume to Capacity ratio			0.37									
Actuated Cycle Length (s)			54.4									
Intersection Capacity Utilization			48.3%									
Analysis Period (min)			15									
c Critical Lane Group												

Timing Report, Sorted By Phase
1: Kamehameha Avenue & Maui Lani Parkway

Central Maui Regional Park

8/26/2013

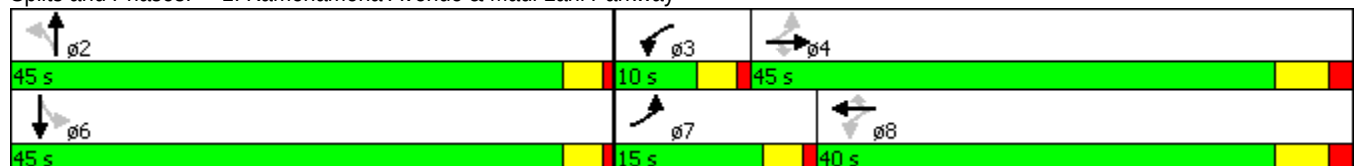


Phase Number	2	3	4	6	7	8
Movement	NBTL	WBL	EBTL	SBTL	EBL	WBTL
Lead/Lag		Lead	Lag		Lead	Lag
Lead-Lag Optimize		Yes	Yes		Yes	Yes
Recall Mode	None	None	Min	None	None	Min
Maximum Split (s)	45	10	45	45	15	40
Maximum Split (%)	45.0%	10.0%	45.0%	45.0%	15.0%	40.0%
Minimum Split (s)	38	10	35	38	10	35
Yellow Time (s)	3	3	4	3	3	4
All-Red Time (s)	1	1	2	1	1	2
Minimum Initial (s)	4	4	4	4	4	4
Vehicle Extension (s)	3	3	3	3	3	3
Minimum Gap (s)	3	3	3	3	3	3
Time Before Reduce (s)	0	0	0	0	0	0
Time To Reduce (s)	0	0	0	0	0	0
Walk Time (s)	7		7	7		7
Flash Dont Walk (s)	25		22	25		22
Dual Entry	Yes	No	Yes	Yes	No	Yes
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	45	55	0	45	60
End Time (s)	45	55	0	45	60	0
Yield/Force Off (s)	41	51	94	41	56	94
Yield/Force Off 170(s)	16	51	94	16	56	94
Local Start Time (s)	0	45	55	0	45	60
Local Yield (s)	41	51	94	41	56	94
Local Yield 170(s)	16	51	94	16	56	94

Intersection Summary

Cycle Length	100
Control Type	Actuated-Uncoordinated
Natural Cycle	85

Splits and Phases: 1: Kamehameha Avenue & Maui Lani Parkway





APPENDIX C

LEVEL OF SERVICE CALCULATIONS

- Base Year 2022 PM Peak
-

HCM Signalized Intersection Capacity Analysis

1: Kamehameha Avenue & Maui Lani Parkway

Central Maui Regional Park

8/26/2013

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	290	370	230	30	295	355	145	430	25	200	320	340
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	6.0	6.0	4.0	6.0	6.0	4.0	6.0		4.0	6.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99		1.00	0.92	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1863	1583	1770	1863	1583	1770	1847		1770	1719	
Flt Permitted	0.24	1.00	1.00	0.41	1.00	1.00	0.09	1.00		0.22	1.00	
Satd. Flow (perm)	455	1863	1583	762	1863	1583	171	1847		419	1719	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	315	402	250	33	321	386	158	467	27	217	348	370
RTOR Reduction (vph)	0	0	165	0	0	246	0	2	0	0	32	0
Lane Group Flow (vph)	315	402	85	33	321	140	158	492	0	217	686	0
Turn Type	pm+pt	NA	Perm	pm+pt	NA	Perm	pm+pt	NA		pm+pt	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4		4	8		8	2			6		
Actuated Green, G (s)	44.7	37.3	37.3	30.0	26.6	26.6	50.5	43.5		59.2	48.2	
Effective Green, g (s)	44.7	37.3	37.3	30.0	26.6	26.6	50.5	43.5		59.2	48.2	
Actuated g/C Ratio	0.39	0.32	0.32	0.26	0.23	0.23	0.44	0.38		0.51	0.42	
Clearance Time (s)	4.0	6.0	6.0	4.0	6.0	6.0	4.0	6.0		4.0	6.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	335	599	509	226	427	363	171	693		350	714	
v/s Ratio Prot	c0.11	0.22		0.00	0.17		c0.06	0.27		c0.06	c0.40	
v/s Ratio Perm	c0.25		0.05	0.03		0.09	0.35			0.25		
v/c Ratio	0.94	0.67	0.17	0.15	0.75	0.39	0.92	0.71		0.62	0.96	
Uniform Delay, d1	29.8	34.0	28.2	32.6	41.6	37.7	26.6	30.8		19.5	32.9	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	33.9	3.0	0.2	0.3	7.3	0.7	47.0	3.4		3.3	24.3	
Delay (s)	63.7	37.0	28.3	32.9	48.9	38.4	73.5	34.3		22.7	57.2	
Level of Service	E	D	C	C	D	D	E	C		C	E	
Approach Delay (s)		43.4			42.7			43.8			49.2	
Approach LOS		D			D			D			D	
Intersection Summary												
HCM 2000 Control Delay			45.0				HCM 2000 Level of Service			D		
HCM 2000 Volume to Capacity ratio			0.98									
Actuated Cycle Length (s)			115.9				Sum of lost time (s)			20.0		
Intersection Capacity Utilization			93.9%				ICU Level of Service			F		
Analysis Period (min)			15									
c Critical Lane Group												

Timing Report, Sorted By Phase
1: Kamehameha Avenue & Maui Lani Parkway

Central Maui Regional Park

8/26/2013

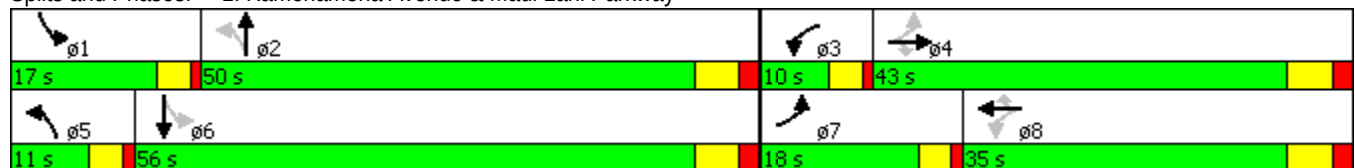


Phase Number	1	2	3	4	5	6	7	8
Movement	SBL	NBTL	WBL	EBTL	NBL	SBTL	EBL	WBL
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	Min	None	None	None	Min
Maximum Split (s)	17	50	10	43	11	56	18	35
Maximum Split (%)	14.2%	41.7%	8.3%	35.8%	9.2%	46.7%	15.0%	29.2%
Minimum Split (s)	10	38	10	35	10	38	10	35
Yellow Time (s)	3	4	3	4	3	4	3	4
All-Red Time (s)	1	2	1	2	1	2	1	2
Minimum Initial (s)	4	4	4	4	4	4	4	4
Vehicle Extension (s)	3	3	3	3	3	3	3	3
Minimum Gap (s)	3	3	3	3	3	3	3	3
Time Before Reduce (s)	0	0	0	0	0	0	0	0
Time To Reduce (s)	0	0	0	0	0	0	0	0
Walk Time (s)		7		7		7		7
Flash Dont Walk (s)		25		22		25		22
Dual Entry	No	Yes	No	Yes	No	Yes	No	Yes
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	17	67	77	0	11	67	85
End Time (s)	17	67	77	0	11	67	85	0
Yield/Force Off (s)	13	61	73	114	7	61	81	114
Yield/Force Off 170(s)	13	36	73	114	7	36	81	114
Local Start Time (s)	103	0	50	60	103	114	50	68
Local Yield (s)	116	44	56	97	110	44	64	97
Local Yield 170(s)	116	19	56	97	110	19	64	97

Intersection Summary

Cycle Length	120
Control Type	Actuated-Uncoordinated
Natural Cycle	95

Splits and Phases: 1: Kamehameha Avenue & Maui Lani Parkway



HCM Unsignalized Intersection Capacity Analysis

2: Road B & Road C

Central Maui Regional Park

8/26/2013

						
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	275	100	165	375	170	85
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	299	109	179	408	185	92
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume			408		1065	299
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			408		1065	299
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			84		11	88
cM capacity (veh/h)			1151		208	741
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2
Volume Total	299	109	179	408	185	92
Volume Left	0	0	179	0	185	0
Volume Right	0	109	0	0	0	92
cSH	1700	1700	1151	1700	208	741
Volume to Capacity	0.18	0.06	0.16	0.24	0.89	0.12
Queue Length 95th (ft)	0	0	14	0	175	11
Control Delay (s)	0.0	0.0	8.7	0.0	84.1	10.6
Lane LOS			A		F	B
Approach Delay (s)	0.0		2.7		59.6	
Approach LOS					F	
Intersection Summary						
Average Delay			14.2			
Intersection Capacity Utilization			43.0%	ICU Level of Service		A
Analysis Period (min)			15			



APPENDIX C

LEVEL OF SERVICE CALCULATIONS

- Base Year 2022 Saturday Peak
-
-

HCM Signalized Intersection Capacity Analysis

1: Kamehameha Avenue & Maui Lani Parkway

Central Maui Regional Park

8/27/2013

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	235	270	230	20	245	150	125	460	25	160	300	275
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	6.0	6.0	4.0	6.0	6.0	4.0	6.0		4.0	6.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Flt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99		1.00	0.93	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1863	1583	1770	1863	1583	1770	1848		1770	1729	
Flt Permitted	0.31	1.00	1.00	0.58	1.00	1.00	0.16	1.00		0.18	1.00	
Satd. Flow (perm)	583	1863	1583	1082	1863	1583	295	1848		333	1729	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	255	293	250	22	266	163	136	500	27	174	326	299
RTOR Reduction (vph)	0	0	169	0	0	129	0	2	0	0	33	0
Lane Group Flow (vph)	255	293	81	22	266	34	136	525	0	174	592	0
Turn Type	pm+pt	NA	Perm	pm+pt	NA	Perm	pm+pt	NA		pm+pt	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4		4	8		8	2			6		
Actuated Green, G (s)	39.1	33.0	33.0	23.2	21.1	21.1	42.4	36.2		50.0	40.0	
Effective Green, g (s)	39.1	33.0	33.0	23.2	21.1	21.1	42.4	36.2		50.0	40.0	
Actuated g/C Ratio	0.39	0.33	0.33	0.23	0.21	0.21	0.42	0.36		0.49	0.39	
Clearance Time (s)	4.0	6.0	6.0	4.0	6.0	6.0	4.0	6.0		4.0	6.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	389	606	515	262	388	329	213	660		306	682	
v/s Ratio Prot	c0.09	0.16		0.00	0.14		0.04	0.28		c0.06	c0.34	
v/s Ratio Perm	c0.16		0.05	0.02		0.02	0.23			0.22		
v/c Ratio	0.66	0.48	0.16	0.08	0.69	0.10	0.64	0.80		0.57	0.87	
Uniform Delay, d1	23.2	27.3	24.3	30.5	37.0	32.4	21.6	29.2		18.2	28.2	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	3.9	0.6	0.1	0.1	5.0	0.1	6.2	6.6		2.4	11.4	
Delay (s)	27.2	27.9	24.4	30.6	42.0	32.6	27.8	35.8		20.6	39.6	
Level of Service	C	C	C	C	D	C	C	D		C	D	
Approach Delay (s)		26.6			38.0			34.2			35.4	
Approach LOS		C			D			C			D	
Intersection Summary												
HCM 2000 Control Delay			33.0									
HCM 2000 Volume to Capacity ratio			0.79									
Actuated Cycle Length (s)			101.3							20.0		
Intersection Capacity Utilization			82.1%									
Analysis Period (min)			15									
c Critical Lane Group												

Timing Report, Sorted By Phase
1: Kamehameha Avenue & Maui Lani Parkway

Central Maui Regional Park

8/27/2013



Phase Number	1	2	3	4	5	6	7	8
Movement	SBL	NBTL	WBL	EBTL	NBL	SBTL	EBL	WBTL
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	Min	None	None	None	Min
Maximum Split (s)	15	60	10	35	10	65	18	27
Maximum Split (%)	12.5%	50.0%	8.3%	29.2%	8.3%	54.2%	15.0%	22.5%
Minimum Split (s)	10	38	10	35	10	38	10	15
Yellow Time (s)	3	4	3	4	3	4	3	4
All-Red Time (s)	1	2	1	2	1	2	1	2
Minimum Initial (s)	4	4	4	4	4	4	4	4
Vehicle Extension (s)	3	3	3	3	3	3	3	3
Minimum Gap (s)	3	3	3	3	3	3	3	3
Time Before Reduce (s)	0	0	0	0	0	0	0	0
Time To Reduce (s)	0	0	0	0	0	0	0	0
Walk Time (s)		7		7		7		7
Flash Dont Walk (s)		25		22		25		2
Dual Entry	No	Yes	No	Yes	No	Yes	No	Yes
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	15	75	85	0	10	75	93
End Time (s)	15	75	85	0	10	75	93	0
Yield/Force Off (s)	11	69	81	114	6	69	89	114
Yield/Force Off 170(s)	11	44	81	114	6	44	89	114
Local Start Time (s)	105	0	60	70	105	115	60	78
Local Yield (s)	116	54	66	99	111	54	74	99
Local Yield 170(s)	116	29	66	99	111	29	74	99

Intersection Summary

Cycle Length	120
Control Type	Actuated-Uncoordinated
Natural Cycle	95

Splits and Phases: 1: Kamehameha Avenue & Maui Lani Parkway

ø1	ø2	ø3	ø4
15 s	60 s	10 s	35 s
ø5	ø6	ø7	ø8
10 s	65 s	18 s	27 s

HCM Unsignalized Intersection Capacity Analysis

2: Road B & Road C

Central Maui Regional Park

8/27/2013

								
Movement	EBT	EBR	WBL	WBT	NBL	NBR		
Lane Configurations								
Volume (veh/h)	260	95	155	355	160	80		
Sign Control	Free			Free	Stop			
Grade	0%			0%	0%			
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92		
Hourly flow rate (vph)	283	103	168	386	174	87		
Pedestrians								
Lane Width (ft)								
Walking Speed (ft/s)								
Percent Blockage								
Right turn flare (veh)								
Median type	None		None					
Median storage veh)								
Upstream signal (ft)								
pX, platoon unblocked								
vC, conflicting volume			386		1005	283		
vC1, stage 1 conf vol								
vC2, stage 2 conf vol								
vCu, unblocked vol			386		1005	283		
tC, single (s)			4.1		6.4	6.2		
tC, 2 stage (s)								
tF (s)			2.2		3.5	3.3		
p0 queue free %			86		24	89		
cM capacity (veh/h)			1173		229	756		
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2		
Volume Total	283	103	168	386	174	87		
Volume Left	0	0	168	0	174	0		
Volume Right	0	103	0	0	0	87		
cSH	1700	1700	1173	1700	229	756		
Volume to Capacity	0.17	0.06	0.14	0.23	0.76	0.11		
Queue Length 95th (ft)	0	0	13	0	133	10		
Control Delay (s)	0.0	0.0	8.6	0.0	57.7	10.4		
Lane LOS			A			F		
Approach Delay (s)	0.0			2.6	41.9			
Approach LOS					E			
Intersection Summary								
Average Delay					10.3			
Intersection Capacity Utilization			41.1%	ICU Level of Service		A		
Analysis Period (min)			15					



APPENDIX C

LEVEL OF SERVICE CALCULATIONS

- Base Year 2022 with Mitigation PM Peak
-

HCM Signalized Intersection Capacity Analysis

1: Kamehameha Avenue & Maui Lani Parkway

Central Maui Regional Park

8/26/2013

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	290	370	230	30	295	355	145	430	25	200	320	340
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	6.0	6.0	4.0	6.0	6.0	4.0	6.0	6.0	4.0	6.0	6.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	1863	1583	1770	1863	1583	1770	1863	1583	1770	1863	1583
Flt Permitted	0.28	1.00	1.00	0.51	1.00	1.00	0.38	1.00	1.00	0.18	1.00	1.00
Satd. Flow (perm)	517	1863	1583	953	1863	1583	708	1863	1583	343	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	315	402	250	33	321	386	158	467	27	217	348	370
RTOR Reduction (vph)	0	0	157	0	0	260	0	0	19	0	0	254
Lane Group Flow (vph)	315	402	93	33	321	126	158	467	8	217	348	116
Turn Type	pm+pt	NA	Perm	pm+pt	NA	Perm	pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4		4	8		8	2		2	6		6
Actuated Green, G (s)	44.6	37.4	37.4	28.4	25.2	25.2	41.2	31.2	31.2	43.6	32.4	32.4
Effective Green, g (s)	44.6	37.4	37.4	28.4	25.2	25.2	41.2	31.2	31.2	43.6	32.4	32.4
Actuated g/C Ratio	0.43	0.36	0.36	0.28	0.24	0.24	0.40	0.30	0.30	0.42	0.31	0.31
Clearance Time (s)	4.0	6.0	6.0	4.0	6.0	6.0	4.0	6.0	6.0	4.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	411	676	574	288	455	387	386	564	479	300	586	497
v/s Ratio Prot	c0.11	0.22		0.00	0.17		0.04	c0.25		c0.08	0.19	
v/s Ratio Perm	c0.22		0.06	0.03		0.08	0.12		0.01	0.23		0.07
v/c Ratio	0.77	0.59	0.16	0.11	0.71	0.33	0.41	0.83	0.02	0.72	0.59	0.23
Uniform Delay, d1	21.7	26.6	22.2	27.5	35.5	31.9	20.9	33.4	25.2	22.2	29.8	26.1
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	8.3	1.4	0.1	0.2	4.9	0.5	0.7	9.7	0.0	8.4	1.6	0.2
Delay (s)	30.0	28.1	22.3	27.7	40.4	32.4	21.6	43.1	25.2	30.5	31.4	26.4
Level of Service	C	C	C	C	D	C	C	D	C	C	C	C
Approach Delay (s)		27.2			35.7			37.2			29.2	
Approach LOS		C			D			D			C	
Intersection Summary												
HCM 2000 Control Delay			31.6	HCM 2000 Level of Service					C			
HCM 2000 Volume to Capacity ratio			0.81									
Actuated Cycle Length (s)			103.0	Sum of lost time (s)					20.0			
Intersection Capacity Utilization			82.0%	ICU Level of Service					D			
Analysis Period (min)			15									
c Critical Lane Group												

Timing Report, Sorted By Phase
1: Kamehameha Avenue & Maui Lani Parkway

Central Maui Regional Park

8/26/2013



Phase Number	1	2	3	4	5	6	7	8
Movement	SBL	NBTL	WBL	EBTL	NBL	SBTL	EBL	WBTL
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	Min	None	None	None	Min
Maximum Split (s)	16	50	10	44	15	51	19	35
Maximum Split (%)	13.3%	41.7%	8.3%	36.7%	12.5%	42.5%	15.8%	29.2%
Minimum Split (s)	10	38	10	35	10	38	10	35
Yellow Time (s)	3	4	3	4	3	4	3	4
All-Red Time (s)	1	2	1	2	1	2	1	2
Minimum Initial (s)	4	4	4	4	4	4	4	4
Vehicle Extension (s)	3	3	3	3	3	3	3	3
Minimum Gap (s)	3	3	3	3	3	3	3	3
Time Before Reduce (s)	0	0	0	0	0	0	0	0
Time To Reduce (s)	0	0	0	0	0	0	0	0
Walk Time (s)		7		7		7		7
Flash Dont Walk (s)		25		22		25		22
Dual Entry	No	Yes	No	Yes	No	Yes	No	Yes
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	16	66	76	0	15	66	85
End Time (s)	16	66	76	0	15	66	85	0
Yield/Force Off (s)	12	60	72	114	11	60	81	114
Yield/Force Off 170(s)	12	35	72	114	11	35	81	114
Local Start Time (s)	104	0	50	60	104	119	50	69
Local Yield (s)	116	44	56	98	115	44	65	98
Local Yield 170(s)	116	19	56	98	115	19	65	98

Intersection Summary

Cycle Length	120
Control Type	Actuated-Uncoordinated
Natural Cycle	95

Splits and Phases: 1: Kamehameha Avenue & Maui Lani Parkway

ø1	ø2	ø3	ø4
16 s	50 s	10 s	44 s
ø5	ø6	ø7	ø8
15 s	51 s	19 s	35 s

HCM Unsignalized Intersection Capacity Analysis

2: Road B & Road C

Central Maui Regional Park

8/26/2013

						
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	275	100	165	375	170	85
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	299	109	179	408	185	92
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume			408		1065	299
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			408		1065	299
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			84		11	88
cM capacity (veh/h)			1151		208	741
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2
Volume Total	299	109	179	408	185	92
Volume Left	0	0	179	0	185	0
Volume Right	0	109	0	0	0	92
cSH	1700	1700	1151	1700	208	741
Volume to Capacity	0.18	0.06	0.16	0.24	0.89	0.12
Queue Length 95th (ft)	0	0	14	0	175	11
Control Delay (s)	0.0	0.0	8.7	0.0	84.1	10.6
Lane LOS			A		F	B
Approach Delay (s)	0.0		2.7		59.6	
Approach LOS					F	
Intersection Summary						
Average Delay			14.2			
Intersection Capacity Utilization			43.0%	ICU Level of Service		A
Analysis Period (min)			15			



APPENDIX C

LEVEL OF SERVICE CALCULATIONS

- Base Year 2022 with Mitigation Saturday Peak
-

HCM Signalized Intersection Capacity Analysis

1: Kamehameha Avenue & Maui Lani Parkway

Central Maui Regional Park

8/27/2013

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	235	270	230	20	245	150	125	460	25	160	300	275
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	6.0	6.0	4.0	6.0	6.0	4.0	6.0	6.0	4.0	6.0	6.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Flt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	1863	1583	1770	1863	1583	1770	1863	1583	1770	1863	1583
Flt Permitted	0.34	1.00	1.00	0.58	1.00	1.00	0.41	1.00	1.00	0.20	1.00	1.00
Satd. Flow (perm)	628	1863	1583	1082	1863	1583	763	1863	1583	366	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	255	293	250	22	266	163	136	500	27	174	326	299
RTOR Reduction (vph)	0	0	162	0	0	127	0	0	18	0	0	202
Lane Group Flow (vph)	255	293	88	22	266	36	136	500	9	174	326	97
Turn Type	pm+pt	NA	Perm	pm+pt	NA	Perm	pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4		4	8		8	2		2	6		6
Actuated Green, G (s)	39.7	33.7	33.7	23.3	21.3	21.3	40.7	31.6	31.6	40.1	31.3	31.3
Effective Green, g (s)	39.7	33.7	33.7	23.3	21.3	21.3	40.7	31.6	31.6	40.1	31.3	31.3
Actuated g/C Ratio	0.41	0.35	0.35	0.24	0.22	0.22	0.42	0.33	0.33	0.42	0.33	0.33
Clearance Time (s)	4.0	6.0	6.0	4.0	6.0	6.0	4.0	6.0	6.0	4.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	430	653	555	276	412	350	418	612	520	281	606	515
v/s Ratio Prot	c0.09	0.16		0.00	0.14		0.03	c0.27		c0.06	0.18	
v/s Ratio Perm	c0.16		0.06	0.02		0.02	0.11		0.01	0.20		0.06
v/c Ratio	0.59	0.45	0.16	0.08	0.65	0.10	0.33	0.82	0.02	0.62	0.54	0.19
Uniform Delay, d1	20.1	24.0	21.4	27.9	34.0	29.8	17.7	29.6	21.8	20.3	26.5	23.3
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	2.2	0.5	0.1	0.1	3.5	0.1	0.5	8.3	0.0	4.0	0.9	0.2
Delay (s)	22.3	24.5	21.6	28.0	37.4	29.9	18.2	37.9	21.8	24.3	27.4	23.5
Level of Service	C	C	C	C	D	C	B	D	C	C	C	C
Approach Delay (s)		22.9			34.3			33.2			25.3	
Approach LOS		C			C			C			C	
Intersection Summary												
HCM 2000 Control Delay			28.0									
HCM 2000 Volume to Capacity ratio			0.71									
Actuated Cycle Length (s)			96.1									
Intersection Capacity Utilization			75.7%									
Analysis Period (min)			15									
c Critical Lane Group												

Timing Report, Sorted By Phase
1: Kamehameha Avenue & Maui Lani Parkway

Central Maui Regional Park

8/27/2013



Phase Number	1	2	3	4	5	6	7	8
Movement	SBL	NBTL	WBL	EBTL	NBL	SBTL	EBL	WBL
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	Min	None	None	None	Min
Maximum Split (s)	13	57	10	40	14	56	19	31
Maximum Split (%)	10.8%	47.5%	8.3%	33.3%	11.7%	46.7%	15.8%	25.8%
Minimum Split (s)	10	38	10	35	10	38	10	15
Yellow Time (s)	3	4	3	4	3	4	3	4
All-Red Time (s)	1	2	1	2	1	2	1	2
Minimum Initial (s)	4	4	4	4	4	4	4	4
Vehicle Extension (s)	3	3	3	3	3	3	3	3
Minimum Gap (s)	3	3	3	3	3	3	3	3
Time Before Reduce (s)	0	0	0	0	0	0	0	0
Time To Reduce (s)	0	0	0	0	0	0	0	0
Walk Time (s)		7		7		7		7
Flash Dont Walk (s)		25		22		25		2
Dual Entry	No	Yes	No	Yes	No	Yes	No	Yes
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	13	70	80	0	14	70	89
End Time (s)	13	70	80	0	14	70	89	0
Yield/Force Off (s)	9	64	76	114	10	64	85	114
Yield/Force Off 170(s)	9	39	76	114	10	39	85	114
Local Start Time (s)	106	119	56	66	106	0	56	75
Local Yield (s)	115	50	62	100	116	50	71	100
Local Yield 170(s)	115	25	62	100	116	25	71	100

Intersection Summary

Cycle Length	120
Control Type	Actuated-Uncoordinated
Natural Cycle	95

Splits and Phases: 1: Kamehameha Avenue & Maui Lani Parkway

13 s	57 s	10 s	40 s
14 s	56 s	19 s	31 s

HCM Unsignalized Intersection Capacity Analysis

2: Road B & Road C

Central Maui Regional Park

8/27/2013

						
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	260	95	155	355	160	80
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	283	103	168	386	174	87
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None		None			
Median storage veh						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume			386		1005	283
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			386		1005	283
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			86		24	89
cM capacity (veh/h)			1173		229	756
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2
Volume Total	283	103	168	386	174	87
Volume Left	0	0	168	0	174	0
Volume Right	0	103	0	0	0	87
cSH	1700	1700	1173	1700	229	756
Volume to Capacity	0.17	0.06	0.14	0.23	0.76	0.11
Queue Length 95th (ft)	0	0	13	0	133	10
Control Delay (s)	0.0	0.0	8.6	0.0	57.7	10.4
Lane LOS			A		F	B
Approach Delay (s)	0.0		2.6		41.9	
Approach LOS					E	
Intersection Summary						
Average Delay	10.3					
Intersection Capacity Utilization	41.1%		ICU Level of Service		A	
Analysis Period (min)	15					



APPENDIX C

LEVEL OF SERVICE CALCULATIONS

- Future Year 2015 PM Peak
-

HCM Signalized Intersection Capacity Analysis

1: Kamehameha Avenue & Maui Lani Parkway

Central Maui Regional Park

10/3/2013

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	230	260	90	50	225	290	70	120	35	165	195	270
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	6.0	6.0	4.0	6.0	6.0	4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Fr _t	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.97		1.00	0.91	
Fl _t Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1863	1583	1770	1863	1583	1770	1800		1770	1701	
Fl _t Permitted	0.44	1.00	1.00	0.59	1.00	1.00	0.22	1.00		0.63	1.00	
Satd. Flow (perm)	828	1863	1583	1092	1863	1583	411	1800		1181	1701	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	250	283	98	54	245	315	76	130	38	179	212	293
RTOR Reduction (vph)	0	0	59	0	0	231	0	12	0	0	57	0
Lane Group Flow (vph)	250	283	39	54	245	84	76	156	0	179	448	0
Turn Type	pm+pt	NA	Perm	pm+pt	NA	Perm	Perm	NA		Perm	NA	
Protected Phases	7	4		3	8			2			6	
Permitted Phases	4		4	8		8	2			6		
Actuated Green, G (s)	35.2	28.1	28.1	22.0	18.9	18.9	25.3	25.3		25.3	25.3	
Effective Green, g (s)	35.2	28.1	28.1	22.0	18.9	18.9	25.3	25.3		25.3	25.3	
Actuated g/C Ratio	0.50	0.40	0.40	0.31	0.27	0.27	0.36	0.36		0.36	0.36	
Clearance Time (s)	4.0	6.0	6.0	4.0	6.0	6.0	4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	577	742	630	370	499	424	147	645		423	610	
v/s Ratio Prot	c0.08	0.15		0.01	c0.13			0.09			c0.26	
v/s Ratio Perm	0.14		0.02	0.04		0.05	0.19			0.15		
v/c Ratio	0.43	0.38	0.06	0.15	0.49	0.20	0.52	0.24		0.42	0.73	
Uniform Delay, d ₁	10.6	15.0	13.1	17.2	21.7	19.9	17.8	15.9		17.1	19.7	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d ₂	0.5	0.3	0.0	0.2	0.8	0.2	3.1	0.2		0.7	4.6	
Delay (s)	11.2	15.4	13.1	17.4	22.5	20.2	20.8	16.1		17.8	24.2	
Level of Service	B	B	B	B	C	C	C	B		B	C	
Approach Delay (s)		13.3			20.9			17.5			22.6	
Approach LOS		B			C			B			C	
Intersection Summary												
HCM 2000 Control Delay			18.8				HCM 2000 Level of Service			B		
HCM 2000 Volume to Capacity ratio			0.59									
Actuated Cycle Length (s)			70.5				Sum of lost time (s)			14.0		
Intersection Capacity Utilization			70.3%				ICU Level of Service			C		
Analysis Period (min)			15									
c Critical Lane Group												

Timing Report, Sorted By Phase
1: Kamehameha Avenue & Maui Lani Parkway

Central Maui Regional Park

10/3/2013

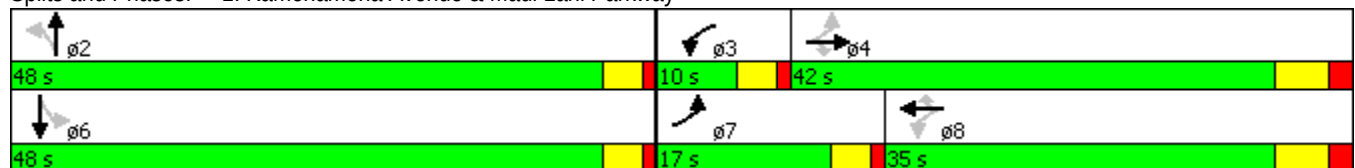


Phase Number	2	3	4	6	7	8
Movement	NBTL	WBL	EBTL	SBTL	EBL	WBTL
Lead/Lag		Lead	Lag		Lead	Lag
Lead-Lag Optimize		Yes	Yes		Yes	Yes
Recall Mode	None	None	Min	None	None	Min
Maximum Split (s)	48	10	42	48	17	35
Maximum Split (%)	48.0%	10.0%	42.0%	48.0%	17.0%	35.0%
Minimum Split (s)	38	10	35	38	10	35
Yellow Time (s)	3	3	4	3	3	4
All-Red Time (s)	1	1	2	1	1	2
Minimum Initial (s)	4	4	4	4	4	4
Vehicle Extension (s)	3	3	3	3	3	3
Minimum Gap (s)	3	3	3	3	3	3
Time Before Reduce (s)	0	0	0	0	0	0
Time To Reduce (s)	0	0	0	0	0	0
Walk Time (s)	7		7	7		7
Flash Dont Walk (s)	25		22	25		22
Dual Entry	Yes	No	Yes	Yes	No	Yes
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	48	58	0	48	65
End Time (s)	48	58	0	48	65	0
Yield/Force Off (s)	44	54	94	44	61	94
Yield/Force Off 170(s)	19	54	94	19	61	94
Local Start Time (s)	0	48	58	0	48	65
Local Yield (s)	44	54	94	44	61	94
Local Yield 170(s)	19	54	94	19	61	94

Intersection Summary

Cycle Length	100
Control Type	Actuated-Uncoordinated
Natural Cycle	85

Splits and Phases: 1: Kamehameha Avenue & Maui Lani Parkway





APPENDIX C

LEVEL OF SERVICE CALCULATIONS

- Future Year 2015 Saturday Peak
-

HCM Signalized Intersection Capacity Analysis

1: Kamehameha Avenue & Maui Lani Parkway

Central Maui Regional Park

10/3/2013

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	185	175	75	45	185	125	70	160	50	135	175	215
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	6.0	6.0	4.0	6.0	6.0	4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Flt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.96		1.00	0.92	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1863	1583	1770	1863	1583	1770	1797		1770	1709	
Flt Permitted	0.50	1.00	1.00	0.64	1.00	1.00	0.29	1.00		0.56	1.00	
Satd. Flow (perm)	938	1863	1583	1188	1863	1583	545	1797		1041	1709	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	201	190	82	49	201	136	76	174	54	147	190	234
RTOR Reduction (vph)	0	0	50	0	0	100	0	14	0	0	55	0
Lane Group Flow (vph)	201	190	32	49	201	36	76	214	0	147	369	0
Turn Type	pm+pt	NA	Perm	pm+pt	NA	Perm	Perm	NA		Perm	NA	
Protected Phases	7	4		3	8			2			6	
Permitted Phases	4		4	8		8	2			6		
Actuated Green, G (s)	30.0	22.8	22.8	18.9	15.7	15.7	19.3	19.3		19.3	19.3	
Effective Green, g (s)	30.0	22.8	22.8	18.9	15.7	15.7	19.3	19.3		19.3	19.3	
Actuated g/C Ratio	0.51	0.38	0.38	0.32	0.26	0.26	0.33	0.33		0.33	0.33	
Clearance Time (s)	4.0	6.0	6.0	4.0	6.0	6.0	4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	619	716	608	410	493	419	177	584		338	556	
v/s Ratio Prot	c0.06	0.10		0.01	c0.11			0.12			c0.22	
v/s Ratio Perm	0.11		0.02	0.03		0.02	0.14			0.14		
v/c Ratio	0.32	0.27	0.05	0.12	0.41	0.09	0.43	0.37		0.43	0.66	
Uniform Delay, d1	8.3	12.5	11.5	14.2	18.0	16.4	15.7	15.3		15.7	17.2	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.3	0.2	0.0	0.1	0.6	0.1	1.7	0.4		0.9	3.0	
Delay (s)	8.6	12.7	11.5	14.3	18.5	16.5	17.4	15.7		16.6	20.2	
Level of Service	A	B	B	B	B	B	B	B		B	C	
Approach Delay (s)		10.8			17.3			16.1			19.3	
Approach LOS		B			B			B			B	
Intersection Summary												
HCM 2000 Control Delay			15.9				HCM 2000 Level of Service			B		
HCM 2000 Volume to Capacity ratio			0.50									
Actuated Cycle Length (s)			59.3				Sum of lost time (s)			14.0		
Intersection Capacity Utilization			61.2%				ICU Level of Service			B		
Analysis Period (min)			15									
c Critical Lane Group												

Timing Report, Sorted By Phase
1: Kamehameha Avenue & Maui Lani Parkway

Central Maui Regional Park

10/3/2013

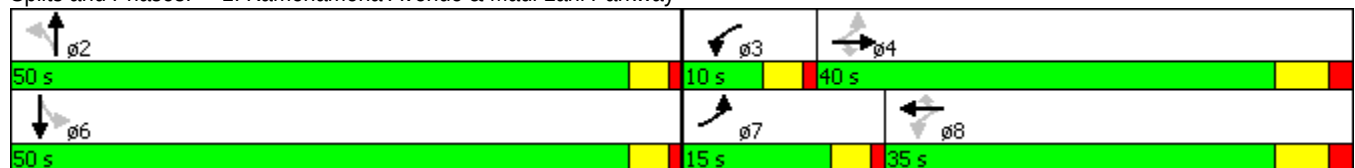


Phase Number	2	3	4	6	7	8
Movement	NBTL	WBL	EBTL	SBTL	EBL	WBTL
Lead/Lag		Lead	Lag		Lead	Lag
Lead-Lag Optimize		Yes	Yes		Yes	Yes
Recall Mode	None	None	Min	None	None	Min
Maximum Split (s)	50	10	40	50	15	35
Maximum Split (%)	50.0%	10.0%	40.0%	50.0%	15.0%	35.0%
Minimum Split (s)	38	10	35	38	10	35
Yellow Time (s)	3	3	4	3	3	4
All-Red Time (s)	1	1	2	1	1	2
Minimum Initial (s)	4	4	4	4	4	4
Vehicle Extension (s)	3	3	3	3	3	3
Minimum Gap (s)	3	3	3	3	3	3
Time Before Reduce (s)	0	0	0	0	0	0
Time To Reduce (s)	0	0	0	0	0	0
Walk Time (s)	7		7	7		7
Flash Dont Walk (s)	25		22	25		22
Dual Entry	Yes	No	Yes	Yes	No	Yes
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	50	60	0	50	65
End Time (s)	50	60	0	50	65	0
Yield/Force Off (s)	46	56	94	46	61	94
Yield/Force Off 170(s)	21	56	94	21	61	94
Local Start Time (s)	0	50	60	0	50	65
Local Yield (s)	46	56	94	46	61	94
Local Yield 170(s)	21	56	94	21	61	94

Intersection Summary

Cycle Length	100
Control Type	Actuated-Uncoordinated
Natural Cycle	85

Splits and Phases: 1: Kamehameha Avenue & Maui Lani Parkway





APPENDIX C

LEVEL OF SERVICE CALCULATIONS

- Future Year 2022 PM Peak
-

HCM Signalized Intersection Capacity Analysis

1: Kamehameha Avenue & Maui Lani Parkway

Central Maui Regional Park

10/3/2013

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	290	370	265	30	295	355	165	455	25	200	345	340
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	6.0	6.0	4.0	6.0	6.0	4.0	6.0	6.0	4.0	6.0	6.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Flt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	1863	1583	1770	1863	1583	1770	1863	1583	1770	1863	1583
Flt Permitted	0.28	1.00	1.00	0.49	1.00	1.00	0.32	1.00	1.00	0.20	1.00	1.00
Satd. Flow (perm)	526	1863	1583	913	1863	1583	590	1863	1583	365	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	315	402	288	33	321	386	179	495	27	217	375	370
RTOR Reduction (vph)	0	0	180	0	0	245	0	0	18	0	0	254
Lane Group Flow (vph)	315	402	108	33	321	141	179	495	9	217	375	116
Turn Type	pm+pt	NA	Perm	pm+pt	NA	Perm	pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4		4	8		8	2		2	6		6
Actuated Green, G (s)	43.5	36.2	36.2	28.4	25.1	25.1	43.2	32.9	32.9	40.8	31.7	31.7
Effective Green, g (s)	43.5	36.2	36.2	28.4	25.1	25.1	43.2	32.9	32.9	40.8	31.7	31.7
Actuated g/C Ratio	0.43	0.36	0.36	0.28	0.25	0.25	0.43	0.32	0.32	0.40	0.31	0.31
Clearance Time (s)	4.0	6.0	6.0	4.0	6.0	6.0	4.0	6.0	6.0	4.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	401	664	564	283	460	391	370	603	513	272	581	494
v/s Ratio Prot	c0.11	0.22		0.00	0.17		0.05	c0.27		c0.07	0.20	
v/s Ratio Perm	c0.22		0.07	0.03		0.09	0.16		0.01	0.25		0.07
v/c Ratio	0.79	0.61	0.19	0.12	0.70	0.36	0.48	0.82	0.02	0.80	0.65	0.23
Uniform Delay, d1	21.7	26.8	22.5	26.8	34.8	31.6	19.7	31.6	23.3	23.0	30.1	25.9
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	9.7	1.6	0.2	0.2	4.6	0.6	1.0	8.8	0.0	14.9	2.5	0.2
Delay (s)	31.4	28.4	22.7	27.0	39.3	32.1	20.7	40.4	23.3	37.9	32.5	26.1
Level of Service	C	C	C	C	D	C	C	D	C	D	C	C
Approach Delay (s)		27.7			35.0			34.7			31.3	
Approach LOS		C			D			C			C	
Intersection Summary												
HCM 2000 Control Delay			31.7									
HCM 2000 Volume to Capacity ratio			0.83									
Actuated Cycle Length (s)			101.5									
Intersection Capacity Utilization			83.3%									
Analysis Period (min)			15									
c Critical Lane Group												

Timing Report, Sorted By Phase
1: Kamehameha Avenue & Maui Lani Parkway

Central Maui Regional Park

10/3/2013

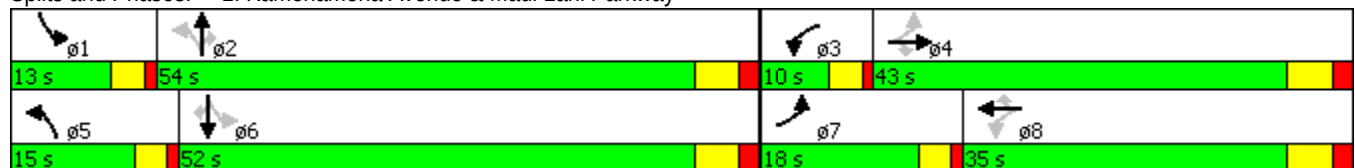


Phase Number	1	2	3	4	5	6	7	8
Movement	SBL	NBTL	WBL	EBTL	NBL	SBTL	EBL	WBTL
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	Min	None	None	None	Min
Maximum Split (s)	13	54	10	43	15	52	18	35
Maximum Split (%)	10.8%	45.0%	8.3%	35.8%	12.5%	43.3%	15.0%	29.2%
Minimum Split (s)	10	38	10	35	10	38	10	35
Yellow Time (s)	3	4	3	4	3	4	3	4
All-Red Time (s)	1	2	1	2	1	2	1	2
Minimum Initial (s)	4	4	4	4	4	4	4	4
Vehicle Extension (s)	3	3	3	3	3	3	3	3
Minimum Gap (s)	3	3	3	3	3	3	3	3
Time Before Reduce (s)	0	0	0	0	0	0	0	0
Time To Reduce (s)	0	0	0	0	0	0	0	0
Walk Time (s)		7		7		7		7
Flash Dont Walk (s)		25		22		25		22
Dual Entry	No	Yes	No	Yes	No	Yes	No	Yes
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	13	67	77	0	15	67	85
End Time (s)	13	67	77	0	15	67	85	0
Yield/Force Off (s)	9	61	73	114	11	61	81	114
Yield/Force Off 170(s)	9	36	73	114	11	36	81	114
Local Start Time (s)	105	118	52	62	105	0	52	70
Local Yield (s)	114	46	58	99	116	46	66	99
Local Yield 170(s)	114	21	58	99	116	21	66	99

Intersection Summary

Cycle Length	120
Control Type	Actuated-Uncoordinated
Natural Cycle	95

Splits and Phases: 1: Kamehameha Avenue & Maui Lani Parkway



HCM Unsignalized Intersection Capacity Analysis

2: Road B/South Access & Road C

Central Maui Regional Park

10/3/2013

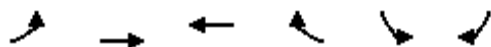
												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	10	290	100	165	405	45	170	10	85	10	5	20
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	11	315	109	179	440	49	185	11	92	11	5	22
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	489			424			1215	1239	370	1258	1269	465
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	489			424			1215	1239	370	1258	1269	465
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	99			84			0	93	86	90	96	96
cM capacity (veh/h)	1074			1135			129	146	676	105	140	598
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2	SB 1	SB 2				
Volume Total	11	424	179	489	185	103	11	27				
Volume Left	11	0	179	0	185	0	11	0				
Volume Right	0	109	0	49	0	92	0	22				
cSH	1074	1700	1135	1700	129	489	105	362				
Volume to Capacity	0.01	0.25	0.16	0.29	1.43	0.21	0.10	0.08				
Queue Length 95th (ft)	1	0	14	0	312	20	8	6				
Control Delay (s)	8.4	0.0	8.8	0.0	295.2	14.3	43.2	15.8				
Lane LOS	A		A		F	B	E	C				
Approach Delay (s)	0.2		2.4		194.5		23.6					
Approach LOS					F		C					
Intersection Summary												
Average Delay			41.0									
Intersection Capacity Utilization			56.6%	ICU Level of Service					B			
Analysis Period (min)			15									

HCM Unsignalized Intersection Capacity Analysis

3: Road C & SW Access

Central Maui Regional Park

10/3/2013



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	60	385	565	30	15	30
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	65	418	614	33	16	33
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	647				1179	630
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	647				1179	630
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	93				92	93
cM capacity (veh/h)	939				196	481
Direction, Lane #	EB 1	EB 2	WB 1	SB 1		
Volume Total	65	418	647	49		
Volume Left	65	0	0	16		
Volume Right	0	0	33	33		
cSH	939	1700	1700	324		
Volume to Capacity	0.07	0.25	0.38	0.15		
Queue Length 95th (ft)	6	0	0	13		
Control Delay (s)	9.1	0.0	0.0	18.1		
Lane LOS	A			C		
Approach Delay (s)	1.2		0.0	18.1		
Approach LOS				C		
Intersection Summary						
Average Delay			1.3			
Intersection Capacity Utilization			48.2%		ICU Level of Service	A
Analysis Period (min)			15			



APPENDIX C

LEVEL OF SERVICE CALCULATIONS

- Future Year 2022 Saturday Peak
-
-

HCM Signalized Intersection Capacity Analysis

1: Kamehameha Avenue & Maui Lani Parkway

Central Maui Regional Park

10/3/2013

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	235	270	280	20	245	150	175	540	25	160	335	275
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	6.0	6.0	4.0	6.0	6.0	4.0	6.0	6.0	4.0	6.0	6.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	1863	1583	1770	1863	1583	1770	1863	1583	1770	1863	1583
Flt Permitted	0.36	1.00	1.00	0.58	1.00	1.00	0.33	1.00	1.00	0.21	1.00	1.00
Satd. Flow (perm)	671	1863	1583	1078	1863	1583	617	1863	1583	383	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	255	293	304	22	266	163	190	587	27	174	364	299
RTOR Reduction (vph)	0	0	211	0	0	124	0	0	17	0	0	200
Lane Group Flow (vph)	255	293	93	22	266	39	190	587	10	174	364	99
Turn Type	pm+pt	NA	Perm	pm+pt	NA	Perm	pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4		4	8		8	2		2	6		6
Actuated Green, G (s)	34.0	28.0	28.0	23.7	21.7	21.7	45.7	35.4	35.4	36.8	30.5	30.5
Effective Green, g (s)	34.0	28.0	28.0	23.7	21.7	21.7	45.7	35.4	35.4	36.8	30.5	30.5
Actuated g/C Ratio	0.37	0.31	0.31	0.26	0.24	0.24	0.50	0.39	0.39	0.40	0.33	0.33
Clearance Time (s)	4.0	6.0	6.0	4.0	6.0	6.0	4.0	6.0	6.0	4.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	348	568	483	293	440	374	448	719	611	248	619	526
v/s Ratio Prot	c0.07	0.16		0.00	0.14		0.05	c0.32		c0.05	0.20	
v/s Ratio Perm	c0.21		0.06	0.02		0.02	0.16		0.01	0.23		0.06
v/c Ratio	0.73	0.52	0.19	0.08	0.60	0.10	0.42	0.82	0.02	0.70	0.59	0.19
Uniform Delay, d1	23.2	26.3	23.5	25.5	31.2	27.4	14.2	25.2	17.4	20.1	25.4	21.8
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	7.8	0.8	0.2	0.1	2.3	0.1	0.6	7.1	0.0	8.7	1.4	0.2
Delay (s)	30.9	27.1	23.7	25.6	33.5	27.5	14.8	32.4	17.4	28.7	26.8	22.0
Level of Service	C	C	C	C	C	C	B	C	B	C	C	C
Approach Delay (s)		27.0			31.0			27.7			25.5	
Approach LOS		C			C			C			C	
Intersection Summary												
HCM 2000 Control Delay			27.4				HCM 2000 Level of Service			C		
HCM 2000 Volume to Capacity ratio			0.80									
Actuated Cycle Length (s)			91.7				Sum of lost time (s)			20.0		
Intersection Capacity Utilization			79.9%				ICU Level of Service			D		
Analysis Period (min)			15									
c Critical Lane Group												

Timing Report, Sorted By Phase
1: Kamehameha Avenue & Maui Lani Parkway

Central Maui Regional Park

10/3/2013

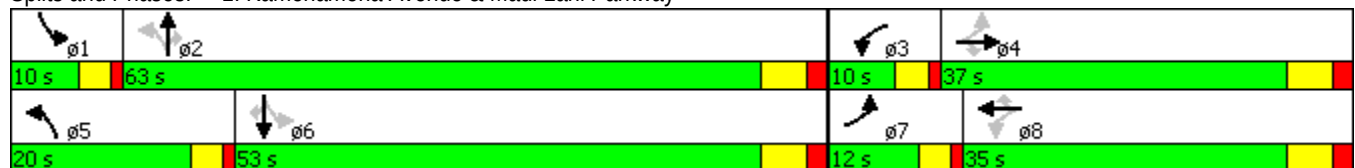


Phase Number	1	2	3	4	5	6	7	8
Movement	SBL	NBTL	WBL	EBTL	NBL	SBTL	EBL	WBTL
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	Min	None	None	None	Min
Maximum Split (s)	10	63	10	37	20	53	12	35
Maximum Split (%)	8.3%	52.5%	8.3%	30.8%	16.7%	44.2%	10.0%	29.2%
Minimum Split (s)	10	38	10	35	10	38	10	35
Yellow Time (s)	3	4	3	4	3	4	3	4
All-Red Time (s)	1	2	1	2	1	2	1	2
Minimum Initial (s)	4	4	4	4	4	4	4	4
Vehicle Extension (s)	3	3	3	3	3	3	3	3
Minimum Gap (s)	3	3	3	3	3	3	3	3
Time Before Reduce (s)	0	0	0	0	0	0	0	0
Time To Reduce (s)	0	0	0	0	0	0	0	0
Walk Time (s)		7		7		7		7
Flash Dont Walk (s)		25		22		25		22
Dual Entry	No	Yes	No	Yes	No	Yes	No	Yes
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	10	73	83	0	20	73	85
End Time (s)	10	73	83	0	20	73	85	0
Yield/Force Off (s)	6	67	79	114	16	67	81	114
Yield/Force Off 170(s)	6	42	79	114	16	42	81	114
Local Start Time (s)	100	110	53	63	100	0	53	65
Local Yield (s)	106	47	59	94	116	47	61	94
Local Yield 170(s)	106	22	59	94	116	22	61	94

Intersection Summary

Cycle Length	120
Control Type	Actuated-Uncoordinated
Natural Cycle	95

Splits and Phases: 1: Kamehameha Avenue & Maui Lani Parkway



HCM Unsignalized Intersection Capacity Analysis

2: Road B/South Access & Road C

Central Maui Regional Park

10/3/2013

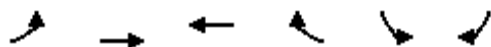
												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	10	305	95	155	395	60	160	10	80	25	15	55
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	11	332	103	168	429	65	174	11	87	27	16	60
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	495			435			1239	1236	383	1245	1255	462
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	495			435			1239	1236	383	1245	1255	462
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	99			85			0	93	87	75	89	90
cM capacity (veh/h)	1069			1125			110	148	664	109	144	600
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2	SB 1	SB 2				
Volume Total	11	435	168	495	174	98	27	76				
Volume Left	11	0	168	0	174	0	27	0				
Volume Right	0	103	0	65	0	87	0	60				
cSH	1069	1700	1125	1700	110	479	109	358				
Volume to Capacity	0.01	0.26	0.15	0.29	1.58	0.20	0.25	0.21				
Queue Length 95th (ft)	1	0	13	0	325	19	23	20				
Control Delay (s)	8.4	0.0	8.8	0.0	367.9	14.4	48.7	17.8				
Lane LOS	A		A		F	B	E	C				
Approach Delay (s)	0.2		2.2		240.7		25.9					
Approach LOS					F		D					
Intersection Summary												
Average Delay			46.9									
Intersection Capacity Utilization			55.9%		ICU Level of Service					B		
Analysis Period (min)			15									

HCM Unsignalized Intersection Capacity Analysis

3: Road C & SW Access

Central Maui Regional Park

10/3/2013



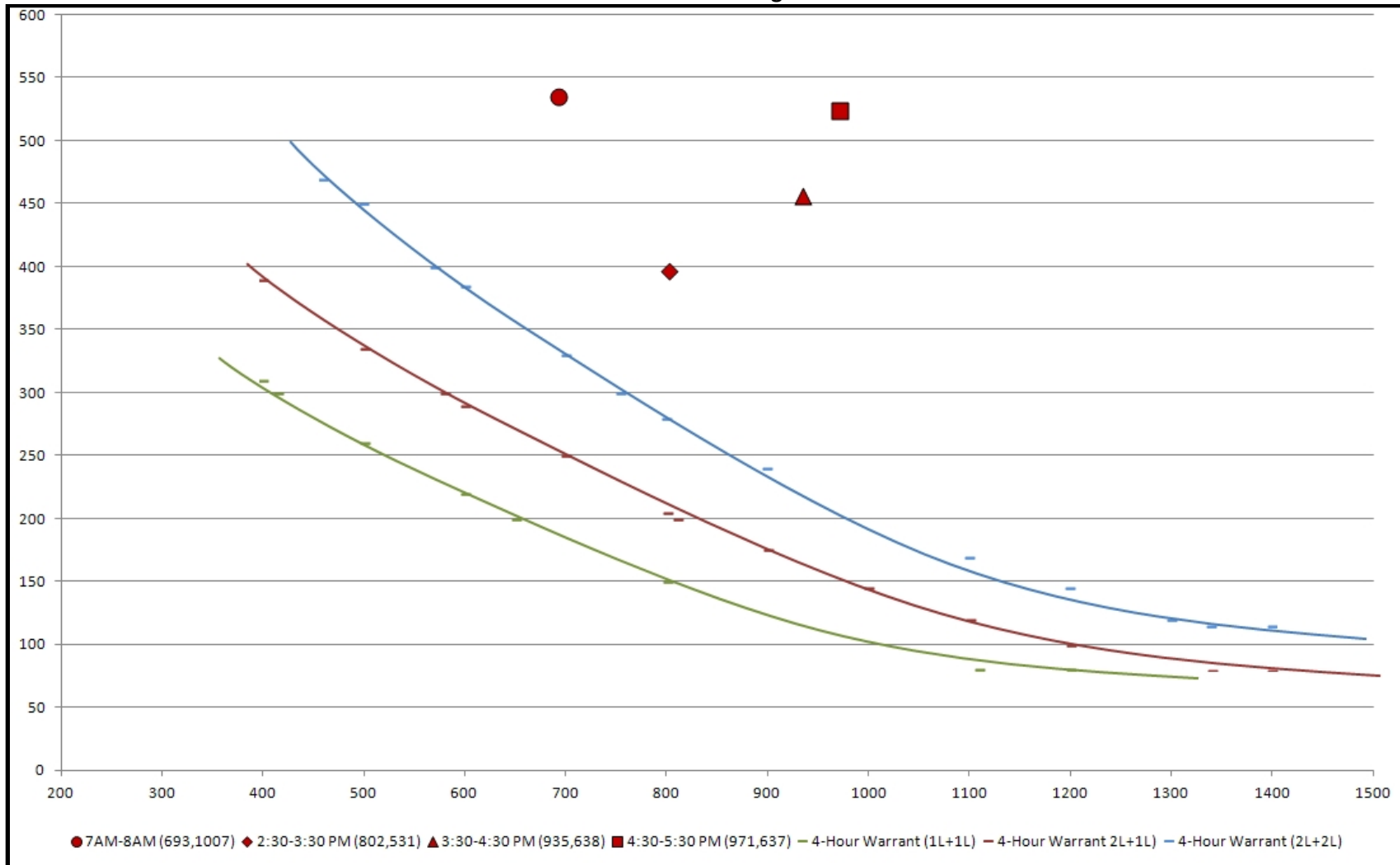
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	80	365	570	40	45	85
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	87	397	620	43	49	92
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	663				1212	641
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	663				1212	641
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	91				73	81
cM capacity (veh/h)	926				182	475
Direction, Lane #	EB 1	EB 2	WB 1	SB 1		
Volume Total	87	397	663	141		
Volume Left	87	0	0	49		
Volume Right	0	0	43	92		
cSH	926	1700	1700	305		
Volume to Capacity	0.09	0.23	0.39	0.46		
Queue Length 95th (ft)	8	0	0	58		
Control Delay (s)	9.3	0.0	0.0	26.6		
Lane LOS	A			D		
Approach Delay (s)	1.7		0.0	26.6		
Approach LOS				D		
Intersection Summary						
Average Delay			3.5			
Intersection Capacity Utilization			54.6%	ICU Level of Service		A
Analysis Period (min)			15			



APPENDIX D

TRAFFIC SIGNAL WARRANT

Appendix D **Traffic Warrant Data based on Existing 2012 Hand Count Data**



Warrants based on the Manual on Uniform Traffic Control Devices (2009), Figure 4C-1.



APPENDIX E

SUPPLEMENTAL SATURDAY PEAK TRIP GENERATION

APPENDIX E – BASE YEAR 2022 TRIP GENERATION

The trip generation rates for the Waiale Development are shown in Table E1 and the trips generated are shown in Table E2.

Table E1:

Waiale Development Updated Trip Generation Rates

Land Use	Independent Variable (X)	PM Peak Hour of Traffic		SAT Peak Hour of Traffic	
		Rate	% In	Rate	% In
General Industrial (ITE Land Use 130)	Square Feet (SF)	$T = 0.74(X) + 46.81$	21%	0.35	32%
Single Family Res. (ITE Land Use 210)	Dwelling Units (DU)	$\ln(T) = 0.90\ln(X) + 0.51$	63%	$T = 0.89(X) + 8.77$	54%
Multi Family Res. (ITE Land Use 230)	Dwelling Units (DU)	$\ln(T) = 0.82\ln(X) + 0.32$	67%	$T = 0.29(X) + 42.63$	54%
Middle School (ITE Land Use 522)	Students	0.16	49%	N/A	N/A
Free-Standing Retail (ITE Land Use 815)	Square Feet (SF)	4.98	50%	7.39	51%
Shopping Center (ITE Land Use 820)	Square Feet (SF)	$\ln(T) = 0.67\ln(X) + 3.31$	48%	$\ln(T) = 0.65\ln(X) + 3.78$	52%

SF GFA = Square Feet of Gross Floor Area

T = Number of Trip Ends

X = Independent Variable

Source: Institute of Transportation Engineers, Trip Generation Handbook, 9th Edition

Table E2:

Waiale Development Generated Traffic

Land Use Designation	Quantity	PM Peak Hour			SAT Peak Hour		
		Enter	Exit	Total	Enter	Exit	Total
General Industrial (130)	175 kSF	38	139	177	20	42	62
Single Family Res. (210)	1,420 DU	722	423	1,145	688	585	1,273
Multi Family Res. (230)	1,130 DU	295	145	440	201	170	371
Middle School (522)	820 Stud.	51	56	107	0	0	0
Free-Standing Retail (815)	250 kSF	623	622	1,245	943	905	1,848
Shopping Center (820)	230 kSF	503	544	1,047	782	721	1,503
TOTAL WAIALE TRIPS		2,246	1,940	4,186	2,634	2,423	5,057

Table E3:

**Waiale Development Saturday Peak Hour Trip Distribution
(based on PM peak hour trip distribution from Waiale TIAR)**

Movement	PM Peak Hour		SAT Peak Hour
	TIAR	% Vol	
1 – Kamehameha Avenue & Maui Lani Parkway			
EB Left	0	0%	0
EB Thru	38	0.9%	46
EB Right	166	4.0%	201
WB Left	0	0%	0
WB Thru	0	0%	0
WB Right	0	0%	0
NB Left	83	2.0%	101
NB Thru	340	8.1%	411
NB Right	0	0%	0
SB Left	0	0%	0
SB Thru	188	4.5%	228
SB Right	0	0%	0
TOTAL	4,186	19.5%	5,057