

Appendix L



Traffic Impact Analysis Report



TRAFFIC IMPACT ANALYSIS REPORT

HONUA'ULA

WAILEA, MAUI, HAWAII

FINAL

March 2, 2010

Prepared for:

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FINAL
TRAFFIC IMPACT ASSESSMENT REPORT
HONUULA
Wailea, 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 development of Honuaula (formally known as Wailea 670) in Wailea. Honuaula will be comprised of mixed uses, residential areas, neighborhood commercial areas, parks, bikeways, walkways and with an 18-hole golf course.

A. Location

Honuaula is situated on approximately 670 acres of land southeast of the Wailea Resort on Maui, which is more specifically identified as TMK: (2) 2-1-008:056 and 071. Neighboring communities include Maui Meadows to the north, Makena Resort to the southwest, and Wailea Resort to the west. Access to Honuaula is provided via the Piilani Highway/Wailea Ike Drive intersection to the north and via Kaukahi Drive to the west. Figure 1 shows the location of Honuaula.

B. Project Description

The original plan for Honuaula included more than 2,000 new single-family and multi-family residential units, two (2) 18-hole golf courses and a large commercial district. Honuaula has since been scaled down and modified. Honuaula currently proposes 1,150 new single-family and multi-family residential units (including 450 workforce affordable homes in compliance with Chapter 2.96



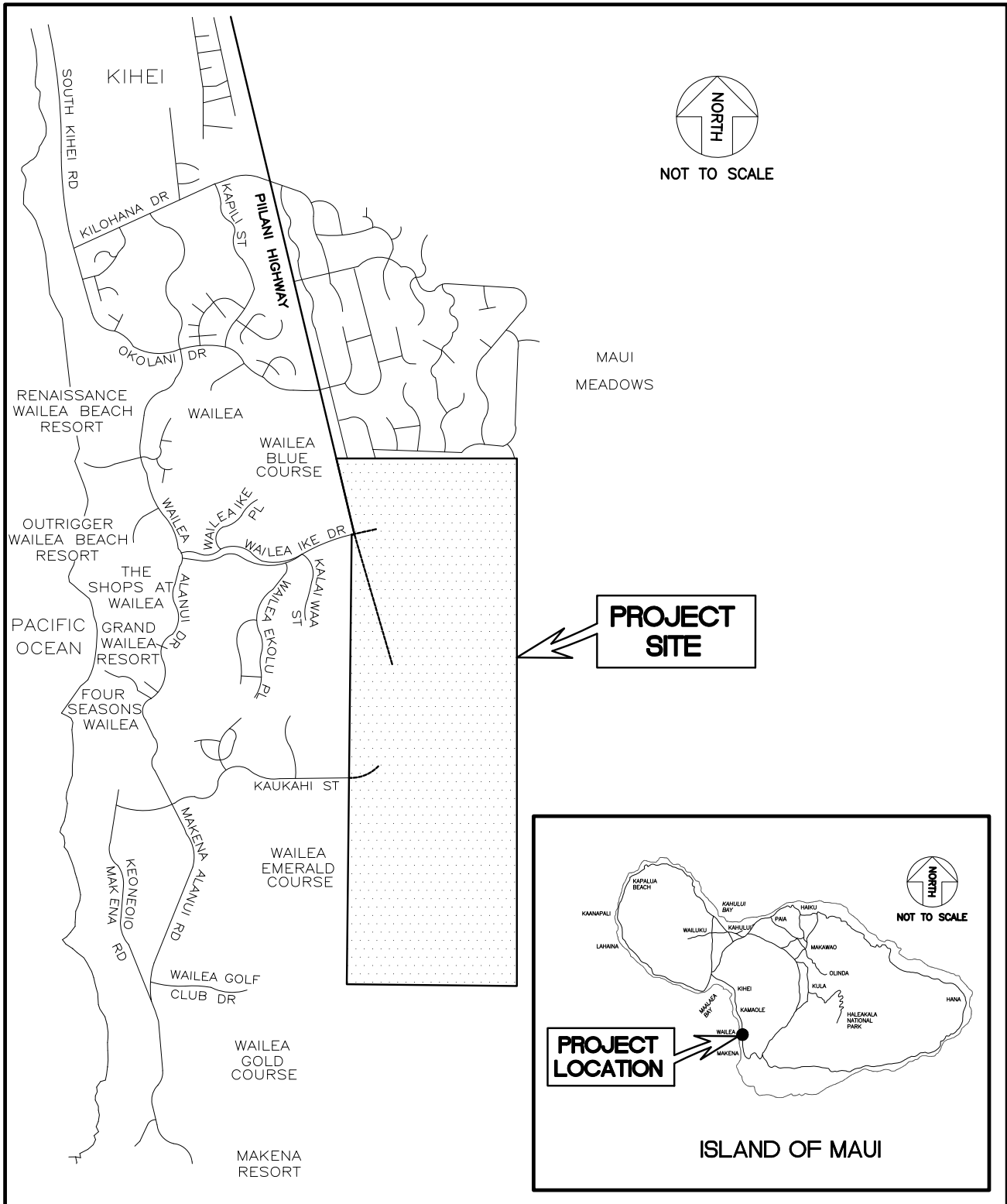
of the Maui County Code), an 18-hole private homeowner golf course and up to 100,000 square feet of commercial and office space.

For the purpose of this study, it is assumed that Honuaula will be constructed in three (3) phases as shown in Table 1. With Phase I of the Project, anticipated completion in Year 2016, the east leg of the Piilani Highway/Wailea Ike Drive intersection (forming a “tee”-intersection, with Piilani Highway being the stem of the tee) will be constructed and Kaukahi Street will be extended into the Project. Since Kaukahi Street is a private street, it is planned to be gated within the Project site to address the concerns of current owners along Kaukahi Street. With Phase II of the Project, anticipated completion in Year 2018, Piilani Highway will be extended beyond Kaukahi Street, forming the south leg of the Piilani Highway/Wailea Ike Drive intersection. Figure 2 shows the conceptual site plan for the Honuaula land uses.

C. Study Methodology

This study will address the following:

1. Existing traffic operating conditions at key intersections within the study area.
2. Traffic Projections for Base Year 2016, 2018, and 2022 (without the project) including traffic generated by an annual defacto growth rate, consistent with the Maui Travel Demand Forecasting Model, 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 expected to affect traffic demand and operations within the study area.
3. Identification of potential traffic conditions for the Base Year 2016, 2018, 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 mitigative measures, as appropriate, to reduce or eliminate the adverse impacts resulting from traffic generated by the Project.



HONUA'ULA

ATA AUSTIN, TSUTSUMI & ASSOCIATES, INC.
ENGINEERS, SURVEYORS HONOLULU, HAWAII

FIGURE

LOCATION MAP

1

Table 1 Proposed Development for Honua'ula		
Land Use	Units	Quantity
Year 2016		
VMX (Office Building)	SF GFA	26,000
VMX (Commercial)	SF GFA	74,000
MF Affordable	DU	75
MF Market Rate	DU	158
MF Townhouse	DU	40
SF Lots	DU	127
Year 2018		
MF Affordable	DU	200
MF Market Rate	DU	30
MF Townhouse	DU	60
SF Lots	DU	110
Year 2022		
MF Affordable	DU	175
MF Market Rate	DU	12
SF Lots	DU	163
TOTAL VMX (SF GFA)		100,000
TOTAL RESIDENTIAL (DU)		1150

DU = Dwelling Units

SF = Single-Family

MF = Multi-Family

VMX = Village Mixed Use

SF GFA = Square Feet of Gross Floor Area



- Legend**
- Single-Family Residential and Roadways
 - Multi-Family Residential and Roadways
 - VMX Village Mixed Use and Roadways
 - Recreation and Open Space / Utility
 - Roadways, Bikeways, and Walkways
 - Golf Course, Open Space, and Parks
 - Native Plant Preservation Area
 - Utilities

HONUA'ULA

WALEA, MAUI

Project Distri
Master Plan





II. EXISTING CONDITIONS

A. Roadway System

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

Piilani Highway - is generally a four-lane, undivided, north/south State arterial highway providing access to Kihei and Wailea from areas north of Kihei. Piilani Highway narrows to a two-lane highway at its intersection with Kilohana Drive/Mapu Place until its terminus at Wailea Ike Drive. Piilani Highway begins at its intersection with South/North Kihei Road and ends at its intersection with Wailea Ike Drive, with provisions to extend the highway further south. Left-turn storage lanes are generally provided at major intersections on Piilani Highway. The posted speed limit on Piilani Highway is generally 40 miles per hour (mph). The speed limit on Piilani Highway is 45 mph in the northbound direction from Wailea Ike Drive to Kilohana Drive; the southbound speed limit on this segment decreases from 45 mph to 25 mph as it approaches Wailea Ike Drive.

South Kihei Road - is an undivided, north/south County collector roadway that is generally parallel to Piilani Highway. South Kihei Road is a two-lane roadway in the vicinity of the study area. South Kihei Road provides local access to shopping centers and visitor accommodations along the Kihei coastline. The posted speed limit on South Kihei Road is generally 20 mph in the study area.

Kilohana Drive - is a two-lane, undivided, east/west roadway that connects South Kihei Road with Piilani Highway, intersecting Piilani Highway across Mapu Place, which provides the north access to Maui Meadows residential subdivision. The posted speed limit on Kilohana Drive is 25 mph.

Mapu Place – is a two-lane, undivided, east/west roadway that provides one (1) of two (2) access points from Piilani Highway, to Maui Meadows residential subdivision. The posted speed limit on Mapu Place is 25 mph.

Wailea Alanui Drive - is a four-lane, divided, north/south collector roadway between Kaukahi Street to the south and Okolani Drive to the north. North of Okolani Drive, Wailea Alanui Drive narrows to a two-lane, undivided, north/south County collector road to its intersection with Kilohana Drive. South of its



intersection with Kaukahi Street, Wailea Alanui Drive becomes Makena Alanui Road. The segment of Wailea Alanui Drive between Wailea Ike Drive and Kaukahi Street has a rolling profile and a meandering alignment. The segment of Wailea Alanui Drive north of Wailea Ike Drive has a less pronounced rolling profile and meandering alignment. The posted speed limit on Wailea Alanui Drive is 30 mph.

Okolani Drive - is a four-lane, divided, east/west roadway between South Kihei Road and Wailea Alanui Drive. Okolani Drive narrows to a two-lane undivided roadway east of Wailea Alanui Drive to its intersection with Piilani Highway directly across of Mikioi Place. The posted speed limit on Okolani Drive is 30 mph.

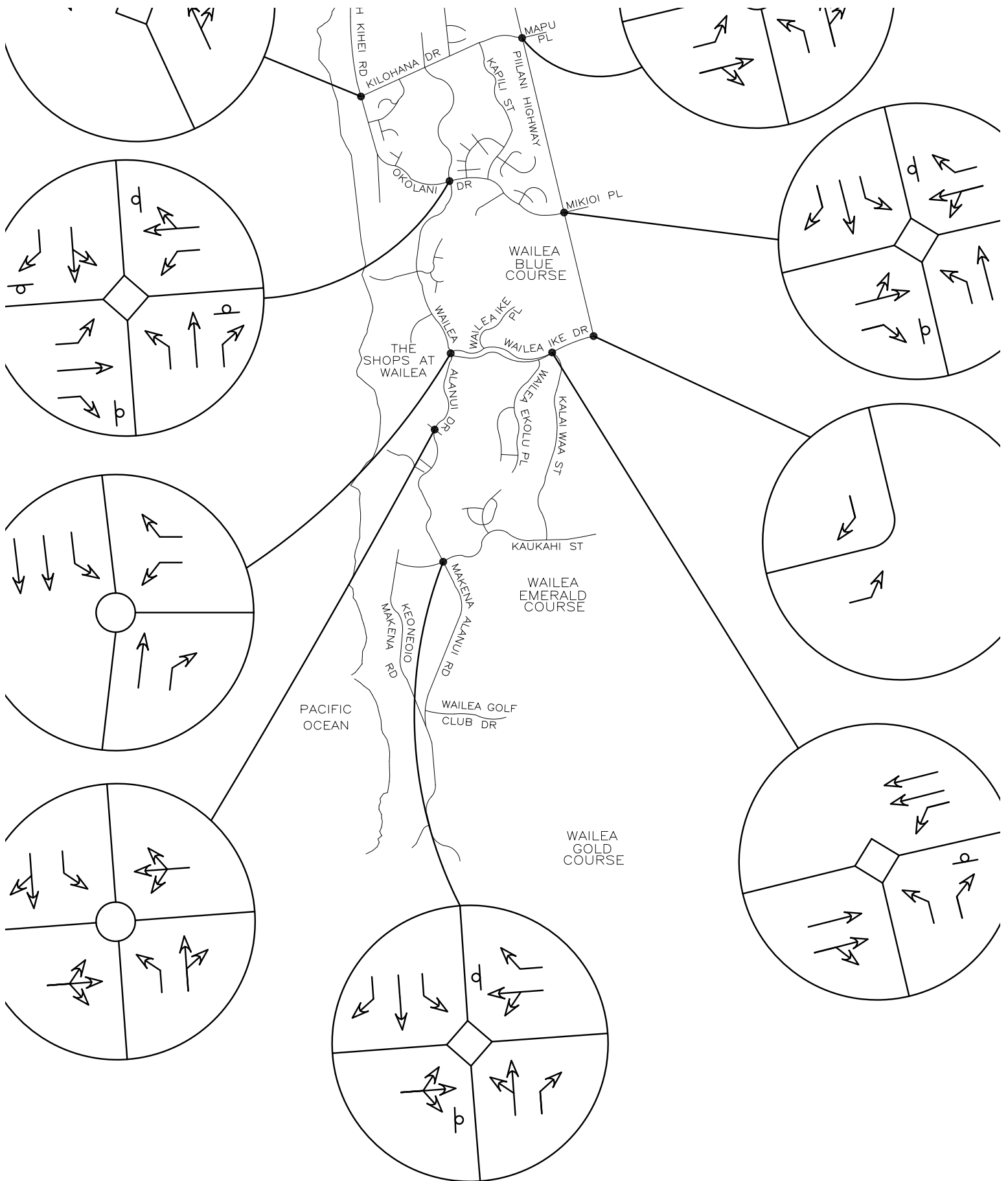
Mikioi Place – is a two-lane, undivided, east/west roadway that provides the southern access point from Piilani Highway, across Okolani Drive, to the Maui Meadows residential subdivision. The posted speed limit on Mikioi Place is 25 mph.

Wailea Ike Drive - is a four-lane, divided, east/west County collector roadway that narrows to a two-lane roadway just before its connection to Piilani Highway. Wailea Ike Drive is the main entrance to the Wailea Resort and connects Piilani Highway with Wailea Alanui Drive. Its vertical alignment is a relatively steep grade with a posted speed limit of 30 mph. Wailea Ike Drive, from its intersection with Wailea Ekolu Place to Wailea Alanui Drive, has a major drainage channel in its median area.

Kalai Waa Street - is a two-lane, undivided, north/south roadway between Kaukahi Street and Wailea Ike Drive. Stop signs are provided at its terminus with Wailea Ike Drive and at its terminus at Kaukauhi Street.

Kaukahi Street – is a two-lane, undivided, east/west roadway between Wailea Alanui Drive/Makena Alanui Road and Kalai Waa Street. Kaukahi Street intersects Wailea Alanui Drive/Makena Alanui Road on the west end and terminates at the Wailea Resort property line on the east end. The Project proposes to extend Kaukahi Street to intersect with the extended Piilani Highway. However, because Kaukahi Street is a private road, the extension of Kaukahi Street into the Project is planned to be a gated access to address the concerns of current owners along Kaukahi Street.

Figure 3 shows the existing roadway system and lane configuration at the study intersections.



LEGEND:





B. Existing Traffic Volumes

Based on the proximity to the project site, the following intersections are studied:

- Piilani Highway/Kilohana Drive/Mapu Place (Signalized)
- Piilani Highway/Okolani Drive/Mikioi Place (Unsignalized)
- Wailea Ike Drive/Kalai Waa Street (Unsignalized)
- Wailea Alanui Drive/Wailea Ike Drive (Signalized)
- Wailea Alanui Drive/Okolani Drive/South Kihei Road (Unsignalized)
- South Kihei Road/Kilohana Drive (Unsignalized)
- Wailea Alanui Drive/Grand Wailea Resort (Signalized)
- Wailea Alanui Drive/Kaukahi Street (Unsignalized)

The AM and PM Peak hour turning movement data utilized in this report were collected on Tuesday June 24, 2008 and Wednesday June 25, 2008. Based on traffic count data, the peak hours of traffic were determined to be from 7:00 AM to 8:00 AM and 4:00 PM to 5:00 PM on the weekdays. The traffic count data is provided in Appendix A.

Traffic count data was taken when public schools were in summer break session for the following reasons:

- Wailea is a resort community and caters to visitor traffic which is highest during the summer months.
- The nearest school to Wailea is located more than a mile north of the Piilani Highway/Kilohana Drive intersection.
- Existing peak hour volumes entering and exiting the Maui Meadows Subdivision (Piilani Highway/Kilohana Drive/Mapu Place and Piilani Highway/Okolani Drive/Mikioi Place intersections) during the AM peak hour of traffic were similar to the existing volumes obtained from the Traffic Impact Analysis Report for Wailea Resort 2005 Update (count data taken in October 2004). This comparison shows that for Maui Meadows, a local residential



subdivision with no recent expansion, traffic volumes are similar during the summer break session than the school session. The PM peak hour of traffic occurred after school hours.

C. Existing Traffic Conditions Analysis and Observations

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, methods for calculating volume to capacity ratios, delays and corresponding Levels of Service were utilized in this study. LOS definitions for signalized intersections are provided in Appendix B.

Methodology

Analysis for the study intersections were performed using the traffic analysis software Synchro, which is able to prepare Highway Capacity Manual (HCM) reports. The reports contain quantitative delay results, as based on intersection lane geometry, signal timing, and hourly traffic volume. In addition, Synchro is able to estimate the queue lengths at the study intersections.

Field Observations

The general paths vehicles utilize when traveling between areas north of Wailea and south in Makena are Piilani Highway, Wailea Ike Drive, and Wailea Alanui Drive. Therefore, at the Wailea Alanui Drive/Wailea Ike Drive intersection, the turning movement volumes are the higher volumes.

During the AM peak hour of traffic, queuing was observed on the northbound through movement at the Piilani Highway/Kilohana Drive/Mapu Place intersection, however, all vehicles were able to clear the intersection within one (1) signal cycle length. During the PM peak hour of traffic, the northbound and southbound through movement volumes were noticeably higher than the AM Peak hour of traffic at the Piilani Highway/Kilohana Drive/Mapu Place intersection. The through traffic at this intersection was higher, but experienced little delay, with vehicles clearing the intersection within one (1) signal cycle length. The eastbound and westbound volumes at the Piilani Highway/Okolani



Drive/Mikioi Place intersection remained fairly low with no more than three (3) vehicles queued at the stop sign.

In its present configuration, the Wailea Alanui Drive/Wailea Ike Drive intersection operates well. The westbound left-turn queue varied from three (3) to eight (8) cars per cycle length, however all vehicles were able to clear the intersection during one (1) cycle length.

All other study intersections appeared to operate sufficiently during both the AM and PM peak hours of traffic.

Results of Intersection Analysis

The analysis and observations described below are based on prevailing conditions during the time at which the data was collected. Hereinafter, observations that are expressed as ongoing and current shall represent the conditions that prevailed at the time at which the data was collected.

Intersections along Piilani Highway

At the signalized intersection of Piilani Highway/Kilohana Drive/Mapu Place, all movements operate overall at LOS D or better during the AM and PM peak hours of traffic.

At the unsignalized intersection of Piilani Highway/Okolani Drive/Mikioi Place, the eastbound left-turn movement operates at LOS F during the PM peak hour of traffic due to minimal gaps in the northbound and southbound approaches. However, as a condition of the Kai Malu Development, a traffic signal is proposed at the Piilani Highway/Okolani Drive/Mikioi Place intersection to alleviate the eastbound left-turn delay. All other movements operate at LOS D or better during the AM and PM peak hours of traffic.

Wailea Ike Drive/Kalai Waa Street Intersection

The unsignalized intersection of Wailea Ike Drive/Kalai Waa Street experience an overall LOS C or better during the AM and PM peak hours of traffic.



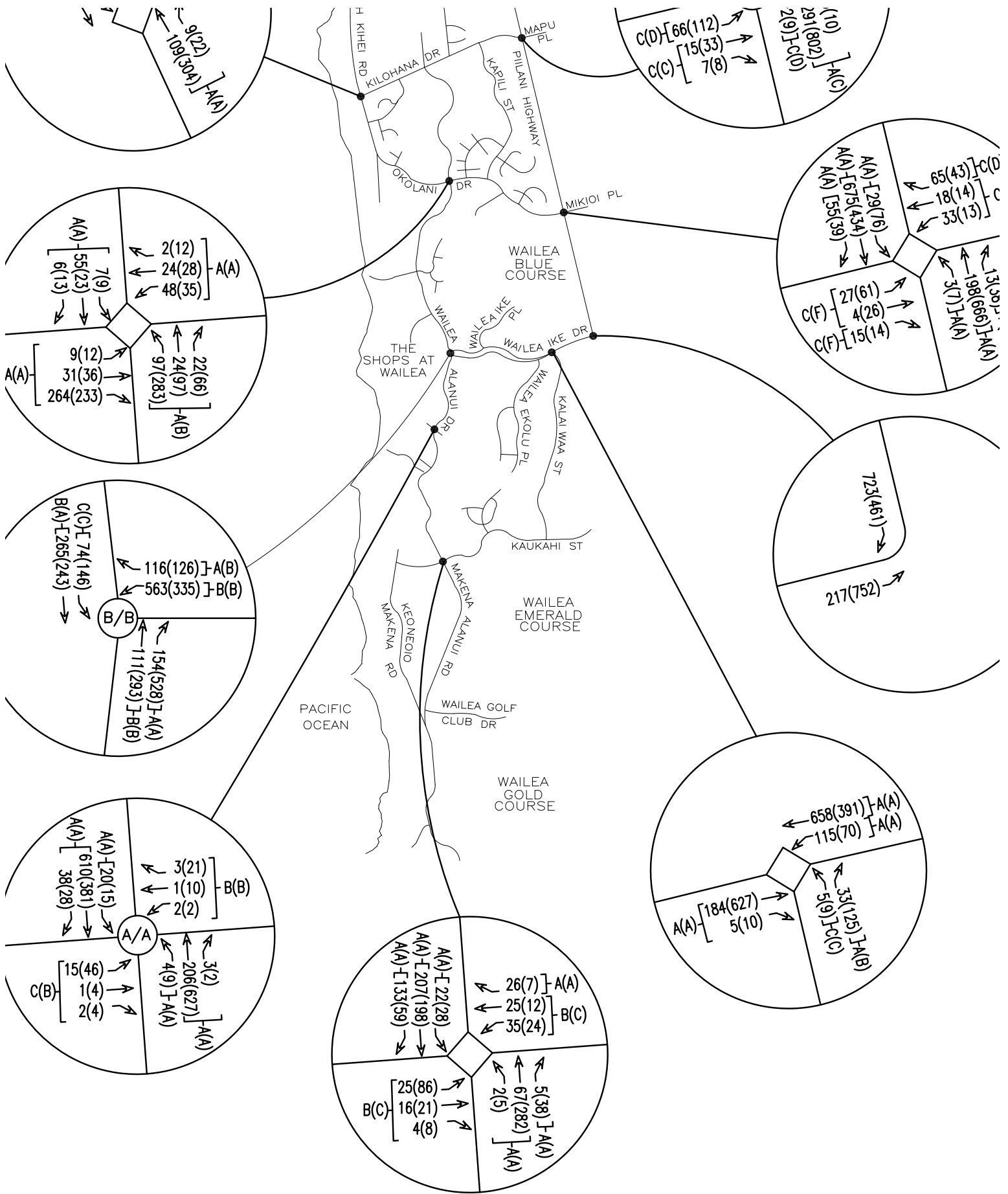
South Kihei Road/Kilohana Drive Intersection

The signalized intersection of South Kihei Road/Kilohana Drive experience an overall LOS B or better during the AM and PM peak hours of traffic.

Intersections Along Wailea Alanui Drive

All intersections along Wailea Alanui Drive operate at an overall LOS C or better during both the AM and PM peak hours of traffic.

Figure 4 shows the existing conditions traffic volumes and level of service and Appendix D shows the level of service summary table.



LEGEND:

1000 VPH (A/B/C) PEAK HOUR OF TRAFFIC VOLUME





III. BASE YEAR TRAFFIC CONDITIONS WITHOUT THE PROJECT

The Year 2016 was selected as the Base Year to reflect the completion year of Phase I of the Project. Year 2018 and 2022 will also be studied to reflect the completion years of Phase II and Phase III, respectively of the Project. Base Year 2016, 2018, and 2022 projections were formulated by applying a defacto growth rate and trips generated by other known developments, as described in the following sections.

A. Defacto Growth Rate

The growth rate of an area is the percentage by which an area will grow over a period of time. The Maui Travel Demand Forecasting Model was utilized to determine a defacto growth rate in the vicinity of the Project. In addition to Honuaula, Wailea Resort and Makena Resort are the main projects proposed in the Wailea/Makena area. Therefore, the data in the Maui Travel Demand Forecasting Model was adjusted to project growth excluding these three (3) projects. The results from the Maui Travel Demand Forecasting Model – consistent with the 2030 Maui County General Plan - show a defacto growth rate of approximately 0.5 percent per year. Therefore, a defacto growth rate of 4.0 percent for Year 2016, 5.1 percent for Year 2018, and 7.2 percent for Year 2022 were applied to existing traffic volumes.

B. Traffic Forecasts for Other Known Developments

Other known developments that are known to be constructed or completed by Years 2016, 2018, and 2022 are further described below. Peak hour vehicular trips were estimated by applying appropriate trip generation rates from the Trip Generation, 8th Edition, published by the Institute of Transportation Engineers (ITE) and the Resort Residential Trip Generation Rate Development prepared by Parsons Brinkerhoff Quade & Douglas, Inc. dated October 2, 2006 as accepted by the State of Hawaii Department of Transportation (SDOT), (herein after referred to as “PB resort rate”). Appendix F shows the PB resort rate report. Vehicular trips generated from the other known developments were distributed to the roadway network based on distribution obtained from the Maui Travel Demand Forecasting Model.

Wailea Resort is generally comprised of the area west of Piilani Highway, north of Makena Road, east of Makena Ala Nui Road and the Pacific



Ocean, and south of Kilohana Drive. Currently, Wailea Resort has constructed most of its parcels. Table 2 shows the proposed development on the remaining parcels of Wailea Resort.

Within the Wailea Resort, some individual parcels were under construction at the time of data collection or existing developments that are proposed to be renovated.

- Under construction were the Kai Malu (MF-8) and Wailea Gateway Projects. Since traffic studies for these Wailea Resort developments were completed, trip generation volumes and distribution were obtained from the Traffic Impact Analysis Report for Wailea MF-8, dated May 13, 2004 and the Traffic Impact Analysis Report for Wailea Gateway, dated March 6, 2006, both prepared by Phillip Rowell and Associates. Since the data collection efforts, both projects have been completed. Kai Malu (MF-8) is located south of Okolani Drive, east of Wailea Alanui Drive, and west of Piilani Highway, with access from Okolani Drive. Kai Malu (MF-8) proposed to construct 153 multi-family units. Wailea Gateway is located on the northwest corner of the Piilani Highway/Wailea Ike Drive intersection with access from Wailea Ike Drive. Wailea Gateway proposed to construct 32,000 square feet of commercial space to be utilized by businesses, restaurants, and retail shops.
- The existing Grand Wailea Resort proposes to renovate two (2) existing restaurants, construct 310 additional hotel rooms, an additional bar, a new cultural center and garden, and additional parking spaces by Year 2016. The Grand Wailea Resort is located south of the Shops at Wailea, east of the Pacific Ocean and west of Wailea Ala Nui Drive. Trip generation volumes and distribution were obtained from the Traffic Impact Report for the Grand Wailea Resort Renovation, dated January 2009, prepared by Wilson Okamoto Corporation.



- The 1 Resort & Residences (formerly Renaissance Wailea Resort) proposes to redevelop the existing 349 hotel units to provide 290 resort hotel units and 40 residential condominium/townhouse units by Year 2016. The 1 Resort & Residences is located north of Wailea Elua, east of the Pacific Ocean, south of Wailea Ekahi, and west of Wailea Alanui Drive. At the time of data collection, the former Renaissance Wailea Resort parcel remained vacant and therefore, trip generation volumes for the proposed redevelopment were obtained from the Traffic Impact Report 1 Resort & Residences, Wailea, dated March 2009, prepared by Wilson Okamoto Corporation. The existing Wailea Blue Golf Course, currently located off of Kaukahi Street, proposes to relocate the existing clubhouse, and provide approximately 8,000 square feet of commercial space, 10,000 square feet of office space, and 5,000 square feet of restaurant space by Year 2016. The Wailea Blue Golf Course clubhouse and additional commercial/office/restaurant space is proposed to be located at the southeast corner of the Wailea Alanui Drive/Wailea Ike Drive intersection, near the existing Matteo's Restaurant.

Makena Resort is comprised of the area east of the Pacific Ocean and south of Makena Road. Table 3 shows the proposed development for the Makena Resort.

Table 4 shows the Other Known Developments Land Uses and Trip Generation and Table 5 shows the Other Known Developments Trip Generation Rates. For the other known developments which utilized The ITE Trip Generation, 8th Edition and PB report rates.

C. Planned Roadway Projects

As a condition for the development of the Kai Malu Project (MF-8), Piilani Highway/Okolani Drive/Mikioi Place intersection will be signalized and the eastbound approach will be restriped to provide an exclusive left-turn lane and a shared through/right-turn lane. At the time of the data collection effort, the Kai Malu Project was under construction. Since then construction has been completed and some of the units have recently been occupied.

Table 2		
Proposed Development on the Remaining Parcels of The Wailea Resort		
Land Use	Units	Quantity
Year 2016		
SF-8 (SF Affordable Units)	DU	95
MF-6 (SF Lots)	DU	57
MF-10 (SF Lots)	DU	10
MF-10 (Condominiums)	DU	36
MF-10 (Grocery)	SF GFA	12,000
MF-10 (Retail)	SF GLA	30,850
MF-10 (Office)	SF GFA	12,200
MF-10 (Restaurant)	SF GFA	8,340
MF-16 (SF Units)	DU	18
MF-7 (MF Units)	DU	75
SF-S (SF Lots)	DU	38
SF-11 (SF Lots)	DU	16
MF-15 (MF Lots)	DU	72
MF-12/13/SF-7A (MF Units)	DU	300
MF-12/13/SF-7A (Hotel Rooms)	ROOMS	60
MF-12/13/SF-7A (Retail)	SF GLA	20,000
MF-9 Hoolei (MF Units)	DU	120
MF-8 Kai Malu (MF Units)	DU	153
Wailea Gateway (Specialty Retail)	SF GLA	32,000
Grand Wailea Resort Renovations	ROOMS	310
Wailea Blue Golf Club (Shopping Center)	SF GLA	23,000
Wailea Blue Golf Club (18-Hole Golf Course)	HOLES	18
1 Resort & Residences, Wailea (Hotel Rooms)	DU	290
1 Resort & Residences, Wailea (Condominiums)	DU	40
Year 2018		
Business 1 (MF Units)	DU	100
Business 2 (Storage)	SF GLA	50,000
Business 2 (Office)	SF GLA	40,000
TOTAL DWELLING UNITS (DU)		
		1,150
TOTAL RESORT HOTEL UNITS		
		640
TOTAL COMMERCIAL/BUSINESS (SF GFA & GLA)		
		228,390

DU = Dwelling Units

SF = Single Family

MF = Multi Family

SF GFA = Square Feet of Gross Floor Area

SF GLA = Square Feet of Gross Leasable Area

Table 3 Proposed Development for Makena Resort		
Land Use	Units	Quantity
Year 2016		
M-2/M-3 (SF Resort)	DU	28
M-4 (MF Resort)	DU	29
M-5 (MF Resort)	DU	110
M-7 (MF Resort)	DU	35
M-9 (MF Resort)	DU	10
M-12 (MF Resort)	DU	54
S-5 (SF Resort)	DU	1
S-6 (SF Resort)	DU	40
Hotel (MF Resort)	DU	44
Maluaka (SF Resort)	DU	13
Maluaka (MF Resort)	DU	2
H-2 (SF Resort)	DU	6
H-2 (MF Resort)	DU	28
Year 2018		
M-5 (MF Resort)	DU	22
M-6 (MF Resort)	DU	60
M-8 (MF Resort)	DU	12
M-9 (MF Resort)	DU	13
S-2 (SF Resort)	DU	17
S-4 (SF Resort)	DU	22
S-7 (SF Resort)	DU	4
Year 2022		
M-1 (SF Resort)	DU	9
M-6 (MF Resort)	DU	9
M-10 (MF Resort)	DU	31
M-11 (MF Resort)	DU	20
S-1 (SF Resort)	DU	90
S-3 (SF Resort)	DU	28
U-1 (SF Resort)	DU	113
TOTAL RESIDENTIAL (DU)		850

DU = Dwelling Units
SF = Single Family Homes
MF = Multi Family Homes

Table 4 Other Known Development's Land Uses and Trip Generation						
	AM PEAK HOUR			PM PEAK HOUR		
	IN	OUT	TOTAL	IN	OUT	TOTAL
BASE YEAR 2016 WAILEA RESORT *						
SF-8	20	57	77	64	37	101
MF-6	13	37	50	41	23	64
MF-10	118	98	216	207	242	449
MF-16	6	17	23	15	8	23
MF-7	8	34	42	33	15	48
SF-S	10	27	37	28	16	44
SF-11	6	15	21	14	7	21
MF-15	7	33	40	31	15	46
MF-12/13/SF-7A	49	118	167	227	174	401
MF-9	11	49	60	47	23	70
Wailea Blue Golf Club	72	34	106	140	149	289
BASE YEAR 2016 MAKENA RESORT **						
M-2/M-3	8	5	13	7	6	13
M-4	3	4	7	4	6	10
M-5	10	15	25	18	20	38
M-7	4	4	8	5	7	12
M-9	2	1	3	1	3	4
M-12	5	7	12	9	10	19
S-5	1	0	1	1	0	1
S-6	12	7	19	10	9	19
Hotel	4	6	10	7	8	15
Maluaka	5	2	7	3	4	7
H-2	5	5	10	6	7	13
BASE YEAR 2016 TOTAL	379	575	954	918	789	1707
BASE YEAR 2018 WAILEA RESORT *						
Business 1	9	43	52	41	20	61
Business 2	165	23	188	27	131	158
BASE YEAR 2018 MAKENA RESORT **						
M-5	2	3	5	3	5	8
M-6	6	8	14	10	11	21
M-8	2	1	3	2	3	5
M-9	2	1	3	2	3	5
S-2	5	3	8	4	4	8
S-4	7	4	11	6	5	11
S-7	2	0	2	1	1	2
BASE YEAR 2018 TOTAL	200	86	286	96	183	279
BASE YEAR 2022 MAKENA RESORT **						
M-1	3	2	5	3	2	5
M-6	1	1	2	1	3	4
M-10	3	4	7	5	6	11
M-11	2	3	5	3	4	7
S-1	25	17	42	21	21	42
S-3	8	5	13	7	6	13
U-1	31	21	52	26	26	52
BASE YEAR 2022 TOTAL	73	53	126	66	68	134

* Wailea Resort Trips generated by these developments were estimated by applying appropriate rates contained in the Institute of Transportation Engineers, Trip Generation, 8th Edition

** Makena Resort Trips generated by these developments were estimated by applying Parsons Brinckerhoff's 2006 single-family and multi-family resort residential trip rates.

Note: Does not include trips generated by Kai Malu Project (MF-8), Wailea Gateway, Grand Wailea Resort Renovations and 1 Resort & Residences, Wailea.

**Table 5
Other Known Development's Trip Generation Rates**

Land Use	Independent Variable (X)	Average Daily Weekday Rate	AM Peak Hour of Traffic		PM Peak Hour of Traffic	
			Rate	% Entering	Rate	% Entering
Single-Family Detached Housing (ITE Land Use 210)	DU	$\text{Ln}(T) = 0.92\text{Ln}(X) + 2.71$	$T = 0.70(X) + 9.74$	25%	$\text{Ln}(T) = 0.90\text{Ln}(X) + 0.51$	63%
Residential Condominium/Townhouse (ITE Land Use 230)	DU	$\text{Ln}(T) = 0.87\text{Ln}(X) + 2.46$	$\text{Ln}(T) = 0.80\text{Ln}(X) + 0.26$	61%	$\text{Ln}(T) = 0.82\text{Ln}(X) + 0.32$	67%
Supermarket (ITE Land Use 850)	1000 SF GFA	$\text{Ln}(T) = 66.95\text{Ln}(X) + 1391.56$	3.59	63%	10.5	51%
Retail (ITE Land Use 814)	1000 SF GFA	$\text{Ln}(T) = 42.78\text{Ln}(X) + 37.66$	$\text{Ln}(T) = 4.91\text{Ln}(X) + 115.59$	48%	$\text{Ln}(T) = 2.40\text{Ln}(X) + 21.48$	44%
General Office Building (ITE Land Use 710)	1000 SF GFA	$\text{Ln}(T) = 0.77\text{Ln}(X) + 3.65$	$\text{Ln}(T) = 0.80\text{Ln}(X) + 1.55$	88%	$\text{Ln}(T) = 1.12\text{Ln}(X) + 78.81$	17%
Restaurant (ITE Land Use 932)	1000 SF GFA	127.15	11.52	52%	11.15	59%
Shopping Center (ITE Land Use 820)	1000 SF GFA	$\text{Ln}(T) = 0.65\text{Ln}(X) + 5.83$	1.00	61%	$\text{Ln}(T) = 0.67\text{Ln}(X) + 3.37$	49%
Mini-Warehouse (ITE Land Use 151)	1000 SF GFA	$\text{Ln}(T) = 1.01\text{Ln}(X) + 0.82$	0.15	59%	$\text{Ln}(T) = 1.02\text{Ln}(X) - 1.49$	51%
Office Park (ITE Land Use 750)	1000 SF GFA	$T = 10.42(X) + 409.04$	$T = 1.37(X) + 124.36$	89%	$T = 1.22(X) + 95.83$	14%
Golf Course (ITE Land Use 430)	HOLE	35.74	2.23	79%	2.78	45%
Multi-Family Resort Residential * (PB Trip Generated Rate)	DU	N/A	0.22	40%	0.34	49%
Single-Family Resort Residential * (PB Trip Generated Rate)	DU	N/A	0.46	58%	0.46	50%

DU = Dwelling Units

SF GFA = Square Feet of Gross Floor Area

T = Number of Trip Ends

X = Independent Variable

Source: Institute of Transportation Engineers, Trip Generation, 8th Edition.



D. Base Year 2016 WITHOUT Project Traffic and Analysis

Since it is a condition of the Kai Malu Project (MF-8), it is assumed that the signalization and re-striping of the Piilani Highway/Okolani Drive/Mikioi Place intersection will be completed by Year 2016. The following are conditions of the study intersections due to the defacto growth rate and other known developments.

Intersections along Piilani Highway (WITHOUT Project)

With a defacto growth rate of 0.5 percent per year along Piilani Highway and the other known developments in the vicinity of the Project, the Piilani Highway/Kilohana Drive/Mapu Place signalized intersection some individual movements will operate at LOS F and over capacity conditions during the AM and PM peak hours of traffic. Currently, Piilani Highway is a four-lane roadway and narrows to a two-lane roadway at the Piilani Highway/Kilohana Drive/Mapu Place intersection where it remains as a two-lane roadway to its terminus at Wailea Ike Drive.

The Piilani Highway/Okolani Drive/Mikioi Place, as a signalized intersection, southbound through movement will operate at LOS F and over capacity conditions during the AM peak hour of traffic. During the PM peak hour of traffic, the northbound through and southbound left-turn movements will operate at LOS F and over capacity conditions.

Therefore, with over capacity conditions at the Piilani Highway/Kilohana Drive/Mapu Place intersection and movements at the Piilani Highway/Okolani Drive/Mikioi Place intersection, it is recommended to widen Piilani Highway between its intersection with Kilohana Drive/Mapu Place and Wailea Ike Drive to a four-lane roadway. The following are the recommended lane configurations at each of the intersections:

Piilani Highway/Kilohana Drive/Mapu Place (signalized)

- Northbound and Southbound Approaches: Provide an exclusive left-turn lane (with a protected left-turn signal phase), two (2) exclusive through lanes, and an exclusive right-turn lane.



- Eastbound Approach: Remain as an exclusive left-turn lane and a shared through/right-turn lane (with a permissive signal phase).
- Westbound Approach: Provide an exclusive left-turn lane, an exclusive through lane and an exclusive right-turn lane (with a permissive signal phase).

Piilani Highway/Okolani Drive/Mikioi Place (signalized)

- Northbound and Southbound Approaches: Provide an exclusive left-turn lane (with a protected left-turn signal phase), an exclusive through lane, and a shared through/right-turn lane.
- Eastbound Approach: Provide an exclusive left-turn lane and a shared through/right-turn lane (with a permissive signal phase).
- Westbound Approach: Remain as a shared left-turn/through/right-turn lane (with a permissive signal phase).

Piilani Highway/Wailea Ike Drive (unsignalized)

- Southbound Approach: Remain as an exclusive free right-turn lane.
- Eastbound Approach: Remain as an exclusive free left-turn lane.
- Northbound and Westbound Approaches will only be constructed with the Project.

With the widening of Piilani Highway, the intersections of Piilani Highway/Kilohana Drive/Mapu Place and Piilani Highway/Okolani Drive/Mikioi Place will operate at LOS D or better during both the AM and PM peak hours of traffic.

Wailea Ike Drive/Kalai Waa Street Intersection (WITHOUT Project)

It is not uncommon, however, for a low volume side street, such as Kalai Waa Street, to experience long delays especially when trying to cross or execute a left-turn onto a high volume roadway, such as Wailea Ike Drive. At the Wailea Ike Drive/Kalai Waa Street intersection, it is projected that approximately 10 and 15 vehicles will utilize the northbound left-turn movement during the AM and PM



peak hours of traffic, respectively. Due to low traffic volumes on Kalai Waa Street, the projected traffic volumes at this intersection do not warrant the installation of a traffic signal system as presented in the Highway Capacity Manual (HCM).

South Kihei Road/Kilohana Drive Intersection (WITHOUT Project)

The South Kihei Road/Kilohana Drive intersection will continue to operate at LOS C or better during both the AM and PM peak hours of traffic.

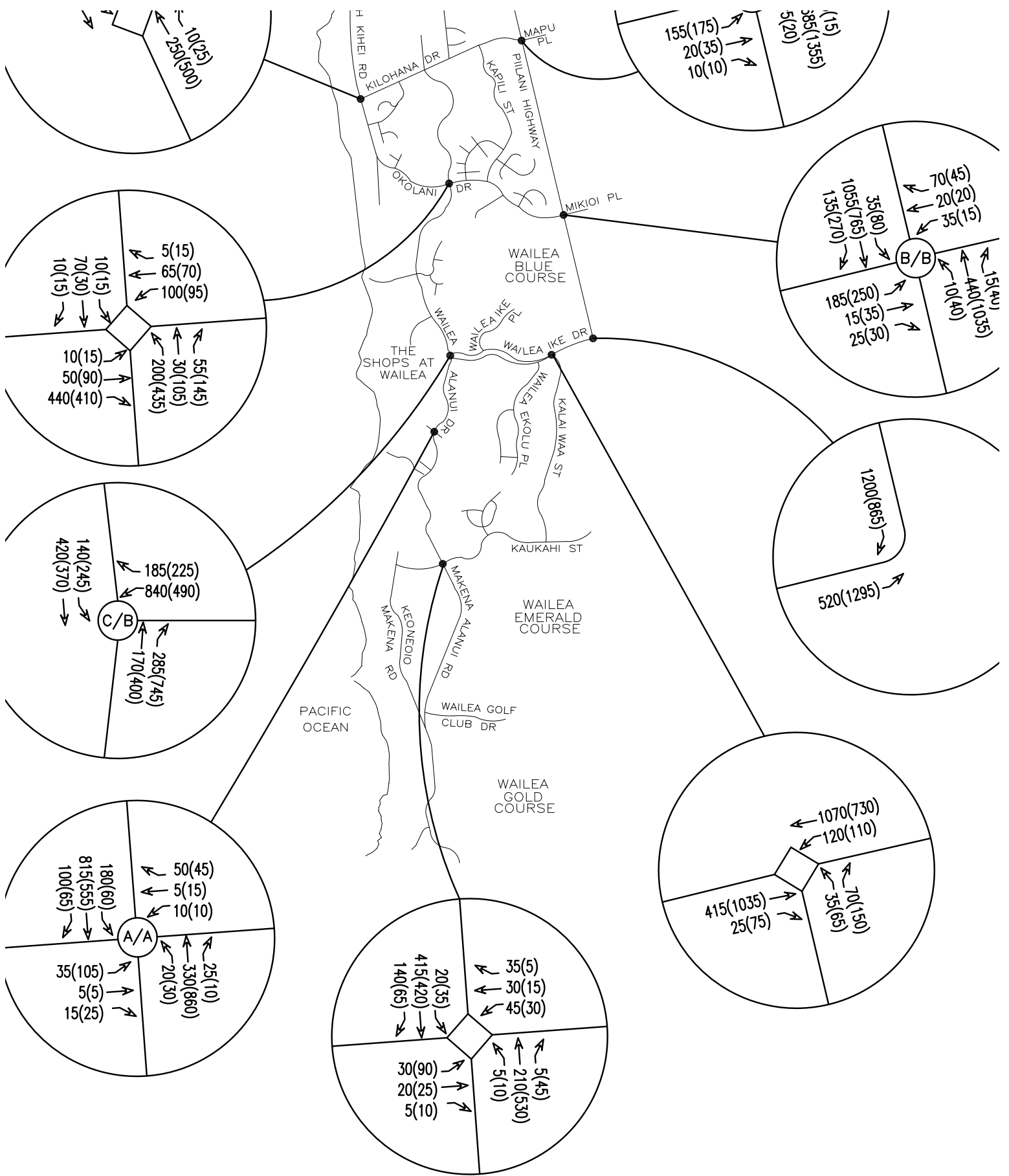
Intersections along Wailea Alanui Drive (WITHOUT Project)

During the PM peak hour of traffic, at the Wailea Alanui Drive/Kaukahi Street intersection, the eastbound shared left-turn/through/right-turn movement will operate at LOS F and the westbound left-turn/through movement will operate at LOS E due to minimal gaps in the northbound and southbound approaches. The eastbound left-turn movement is projected to generate approximately 90 vehicles, however, providing an eastbound left-turn lane will improve the movement by approximately 15 seconds (operate at LOS F) and allow the through and right-turn vehicles to proceed through the intersection (operate at LOS C). Therefore, it is recommended that the eastbound approach be restriped to provide an exclusive left-turn lane and a shared through/right-turn lane, and for alignment purposes, it is recommended that the westbound approach be restriped to also provide an exclusive left-turn lane and a shared through/right-turn lane. The westbound left-turn will operate at LOS E, however it is projected to generate a relatively low volume (approximately 30 vehicles). All other movements operate at LOS C or better PM peak hour of traffic. During the AM peak hours of traffic, all movements operate at LOS C or better.

The projected traffic volumes at the Wailea Alanui Drive/Kaukahi Street intersection do not warrant the installation of a traffic signal system.

All other intersections along Wailea Alanui Drive will continue to operate at LOS D or better during both the AM and PM peak hours of traffic.

Figure 5 shows the traffic volumes and LOS at the study intersections for Base Year 2016. Appendix D shows the level-of-service summary table at all the study intersections and Appendix E shows the recommended lane configuration.



LEGEND:

##(##) - AM(PM) PEAK HOUR OF TRAFFIC VOL

∠ - UNSIGNALIZED INTERSECTION





E. Base Year 2018 WITHOUT Project Traffic and Analysis

It is assumed that mitigative measures recommended in Base Year 2016 have been completed by Base Year 2018.

Intersections along Piilani Highway (WITHOUT Project)

With improvements as recommended for Base Year 2016 completed, intersections along Piilani Highway will operate at LOS D or better during the AM and PM peak hours of traffic.

Wailea Ike Drive/Kalai Waa Street Intersection (WITHOUT Project)

The Wailea Ike Drive/Kalai Waa Street intersection northbound left-turn movement will operate at LOS F during the AM peak hour of traffic and will continue to operate at LOS F during the PM peak hour of traffic. With projected volumes at the intersection do not warrant a traffic signal system. All other movements will operate at LOS D or better during the AM and PM peak hours of traffic.

South Kihei Road/Kilohana Drive Intersection (WITHOUT Project)

The South Kihei Road/Kilohana Drive intersection will continue to operate at LOS C or better during both the AM and PM peak hours of traffic.

Intersections along Wailea Alanui Drive (WITHOUT Project)

The northbound left-turn movement at the all-way stop-controlled intersection of Wailea Alanui Drive/Okolani Drive will operate at LOS E during the PM peak hour of traffic. Much of the traffic traveling north on Wailea Alanui Drive headed toward Kihei utilize the northbound left-turn (220 and 485 vehicles during the AM and PM peak hours of traffic, respectively) at the Wailea Alanui Drive/Okolani Drive intersection to access South Kihei Road. In the opposing direction, much of the traffic utilizes the eastbound left-turn (485 and 435 vehicles during the AM and PM peak hours of traffic, respectively) at the Wailea Alanui Drive/Okolani Drive coming from South Kihei Road to access Wailea Alanui Drive. To mitigate the LOS E conditions on the northbound left-turn movement, a roundabout was studied since the projected volumes do not warrant a traffic signal system. However, in accordance with the Roundabouts: An Informational Guide, published by The U.S. Department of Transportation Federal Highway



Administration, dated June 2000, “It is generally not desirable to locate roundabouts in locations where grades through the intersection are greater than four percent.” This is recommended due to the difficulty of vehicles entering the roundabout on the downslope to slow down or stop. In the opposing direction, on the upslope, there may be limited sight distance for vehicles entering the roundabout. Therefore, a roundabout is not recommended at the Wailea Alanui Drive/Okolani Drive intersection where the existing slopes along Okolani Drive appear to be greater than 4.0 percent. Projected volumes at the intersection do not warrant a traffic signal system. During the AM peak hour of traffic, all movements will continue to operate at LOS B or better.

The Wailea Alanui Drive/Kaukahi Street intersection eastbound left-turn movement will continue to operate at LOS F and the westbound left-turn movement will continue to operate at LOS E during the PM peak hour of traffic. With projected volumes at the intersection do not warrant a traffic signal system. During the AM peak hour of traffic, all movements will continue to operate at LOS C or better.

All other intersections along Wailea Alanui Drive will continue to operate at LOS D or better during the AM and PM peak hours of traffic.

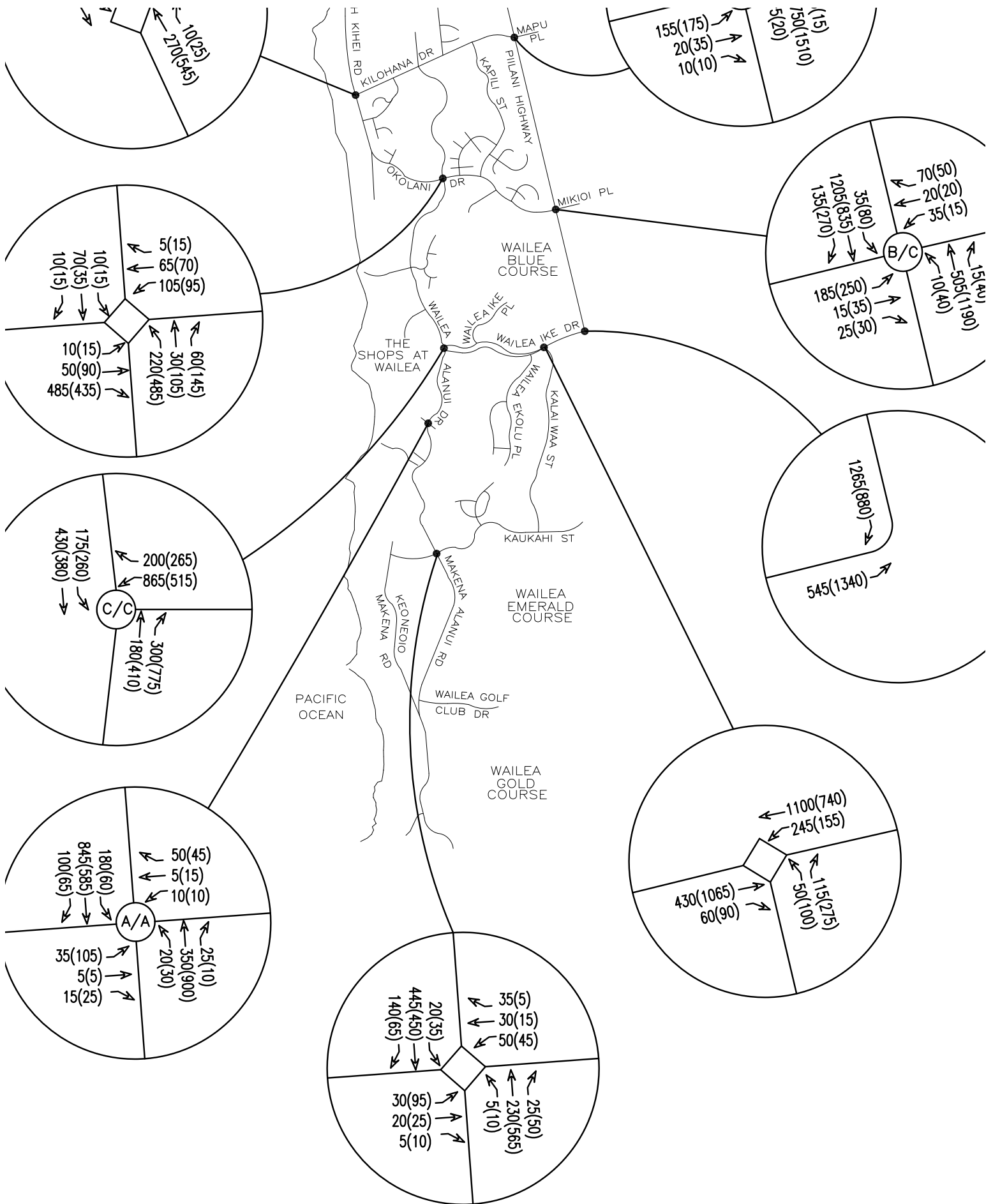
Figure 6 shows the traffic volumes and LOS at the study intersections for Base Year 2018. Appendix D shows the level-of-service table summary at all the study intersections and Appendix E shows the recommended lane configuration.

F. Base Year 2022 WITHOUT Project Traffic and Analysis

It is assumed that mitigative measures recommended in Base Year 2016 have been completed by Base Year 2022.

Intersections along Piilani Highway (WITHOUT Project)

With improvements as recommended for Base Year 2016 completed, intersections along Piilani Highway will continue to operate at LOS D or better during the AM and PM peak hours of traffic.



LEGEND:

##(##) - AM(PM) PEAK HOUR OF TRAFFIC VOL

 - UNSIGNALIZED INTERSECTION



Wailea Ike Drive/Kalai Waa Street Intersection (WITHOUT Project)

The Wailea Ike Drive/Kalai Waa Street intersection northbound left-turn movement will continue to operate at LOS F during the AM and PM peak hours of traffic. Additionally, during the PM peak hour of traffic the northbound right-turn movement will operate at LOS E. With projected volumes at both intersections most likely will not warrant a traffic signal. All other movements will continue to operate at LOS D or better during the AM and PM peak hours of traffic.

South Kihei Road/Kilohana Drive Intersection (WITHOUT Project)

The South Kihei Road/Kilohana Drive intersection will continue to operate at LOS C or better during both the AM and PM peak hours of traffic.

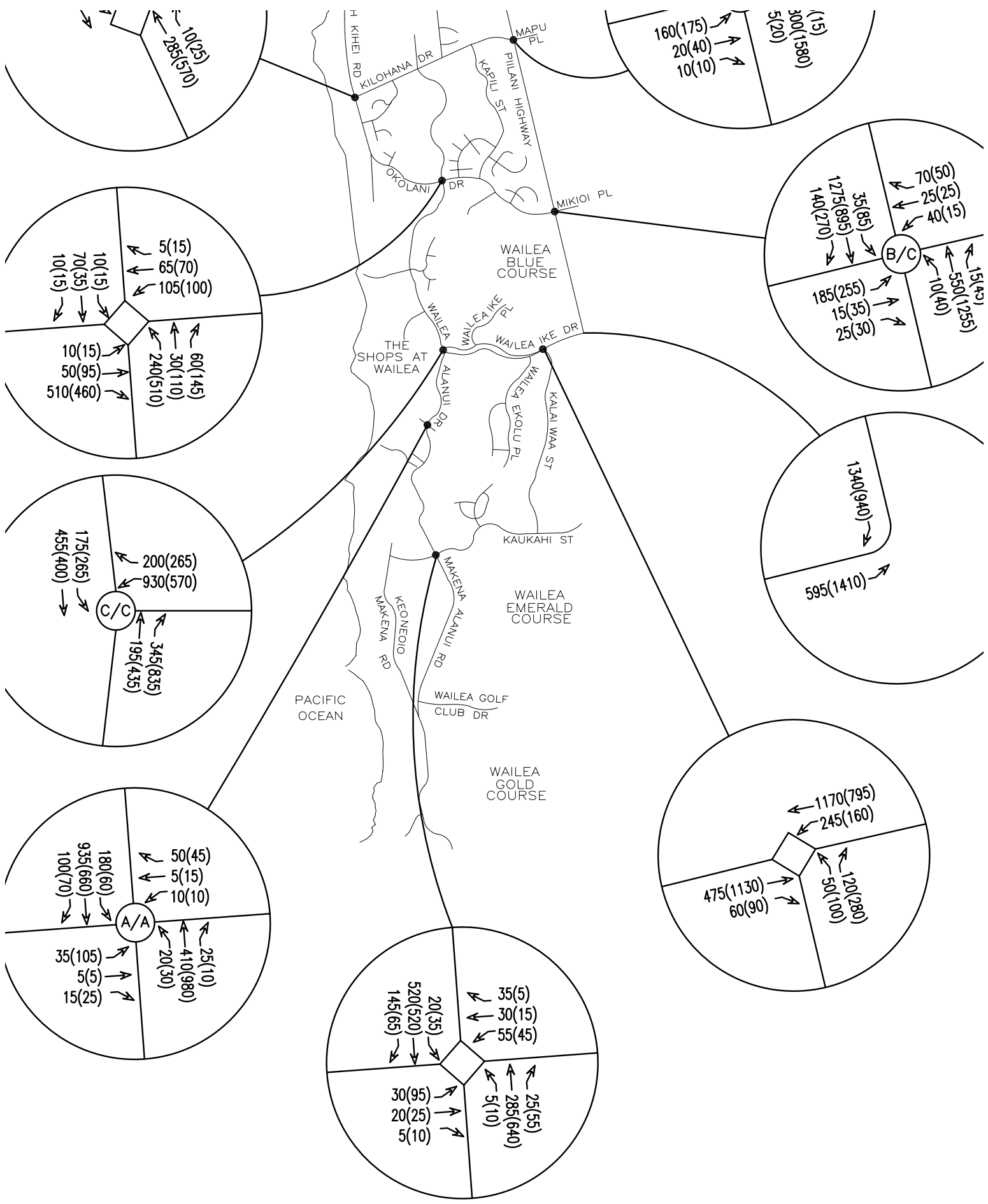
Intersections along Wailea Alanui Drive (WITHOUT Project)

The northbound left-turn movement at the intersection of Wailea Alanui Drive/Okolani Drive will operate at LOS F during the PM peak hour of traffic. However, as mentioned in Section III.E., a roundabout is not recommended at this intersection due to the slope along Okolani Drive. Projected volumes at this intersection most likely will not warrant a traffic signal system. During the AM peak hour of traffic, all movements will continue to operate at LOS B or better.

The Wailea Alanui Drive/Kaukahi Street intersection eastbound left-turn and the westbound left-turn movements will operate at LOS F during the PM peak hour of traffic. Projected volumes at the intersection most likely will not warrant a traffic signal. During the AM peak hour of traffic, all movements will operate at LOS D or better.

All other intersections along Wailea Alanui Drive will continue to operate at LOS D or better during the AM and PM peak hours of traffic.

Figure 7 shows the traffic volumes and LOS at the study intersections for Base Year 2022. Appendix D shows the level-of-service table summary at all the study intersections and Appendix E shows the recommended lane configuration.



LEGEND:

- ##(##) - AM(PM) PEAK HOUR OF TRAFFIC VOL
- ◁ - UNSIGNALIZED INTERSECTION





IV. FUTURE YEAR TRAFFIC CONDITIONS WITH THE PROJECT

A. Trip Generation

Trip generation estimates the total number of trips produced by a given land use. Trip rates contained in the nationally published ITE, Trip Generation, 8th Edition were used to estimate the number of trips generated by the Project. Additionally, the Resort Residential Trip Generation Rate Development prepared by Parsons Brinkerhoff Quade & Douglas, Inc. dated October 2, 2006 as accepted by the SDOT, is utilized to estimate the number of trips generated by resort residential units. Table 5, as shown in the previous section, shows these trip generation rates and Table 6 shows the number of peak hour trips that are expected to be generated by the Project.

An estimation of the percentage of internal trip capture was obtained from the ITE Trip Generation Handbook, Second Edition, which was determined to be approximately 15 percent. The internal trip capture was only applied to the PM peak hour of traffic since commercial areas are typically closed during the AM peak hour of traffic. The 15 percent internal trip capture rate was applied to the number of residential trips and the result was applied to the commercial trips, in order to match the number of internal trips between the residential areas and commercial areas. Internal trips are assumed within the Project.

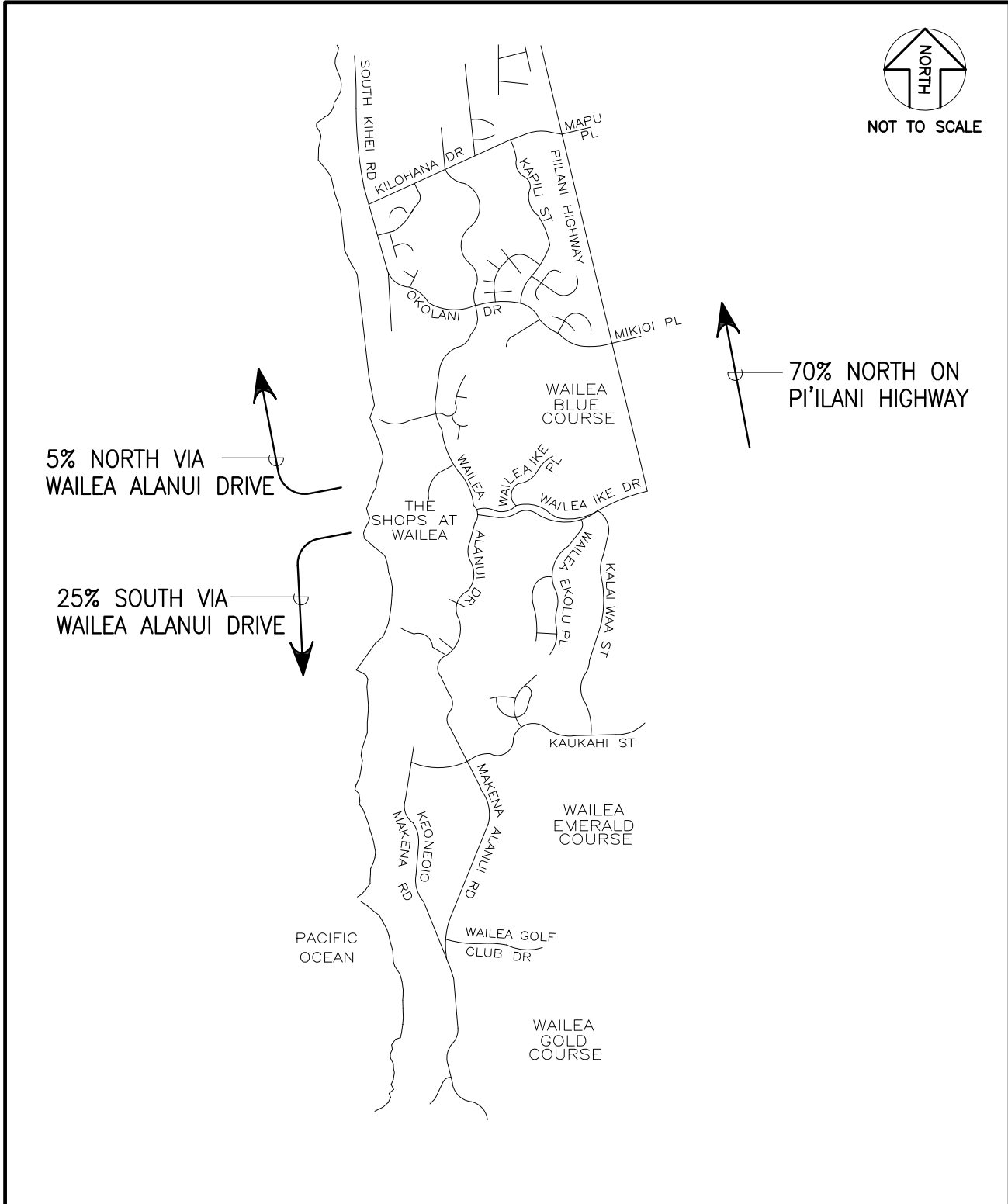
B. Trip Distribution

The Project generated trips were distributed based on the distribution utilized by the Maui Travel Demand Forecasting Model; Figure 8 shows the general distribution. Phase I of the Project proposes to construct the east leg of the Piilani Highway/Wailea Ike Drive intersection and Kaukahi Street will be extended into the Project. Since Kaukahi Street is a private street, it is planned to be gated within the Project site to address concerns of current owners along the street. Phase II of the Project proposes to extend Piilani Highway, forming the south leg of the Piilani Highway/Wailea Ike Drive intersection. Figures 9, 10, and 11 show the Project generated traffic volumes during Year 2016, 2018, and 2022, respectively.

Table 6 Project Generated Peak Hour Trips												
LAND USE	ITE CODE #	Units	Quantity	Avg. Daily Trips	AM Peak Hour		PM Peak Hour		Total	In	Out	Total
					In	Out	In	Out				
YEAR 2016												
VMX (General Office Building)	720	SF GFA	26,000	940	57	7	64	19	89	108		
VMX (Commercial)	820	SF GFA	74,000	4978	100	62	162	303	313	616		
MF Affordable Housing	230	DU	75	501	8	34	42	33	15	48		
MF Townhouse	230	DU	40	290	5	20	25	20	9	29		
SF Detached Housing	PB	DU	127	N/A	35	24	59	30	29	59		
MF Market Rate Villas	PB	DU	158	N/A	15	21	36	28	26	54		
YEAR 2018												
SF Detached Housing	PB	DU	110	N/A	30	21	51	26	25	51		
MF Market Rate Villas	PB	DU	30	N/A	3	4	7	6	5	11		
MF Townhouse	230	DU	60	193	8	33	41	32	14	46		
MF Affordable Housing	230	DU	200	570	18	86	104	82	39	121		
YEAR 2022												
SF Detached Housing	PB	DU	163	N/A	44	31	75	38	37	75		
MF Market Rate Villas	PB	DU	12	N/A	2	1	3	3	2	4		
MF Affordable Housing	230	DU	175	1047	14	67	81	65	31	96		
		TOTAL	100,000 SF GFA 1,150 DU		339	411	750	685	634	1318		

DU = Dwelling Units
 SF GFA = Square Feet of Gross Floor Area
 SF = Single-Family
 MF = Multi-Family
 VMX = Village Mixed Use

Source: Institute of Transportation Engineers, Trip Generation, 8th Edition.
 Parsons Brinckerhoff's 2006 single-family and multi-family resort residential trip rates.



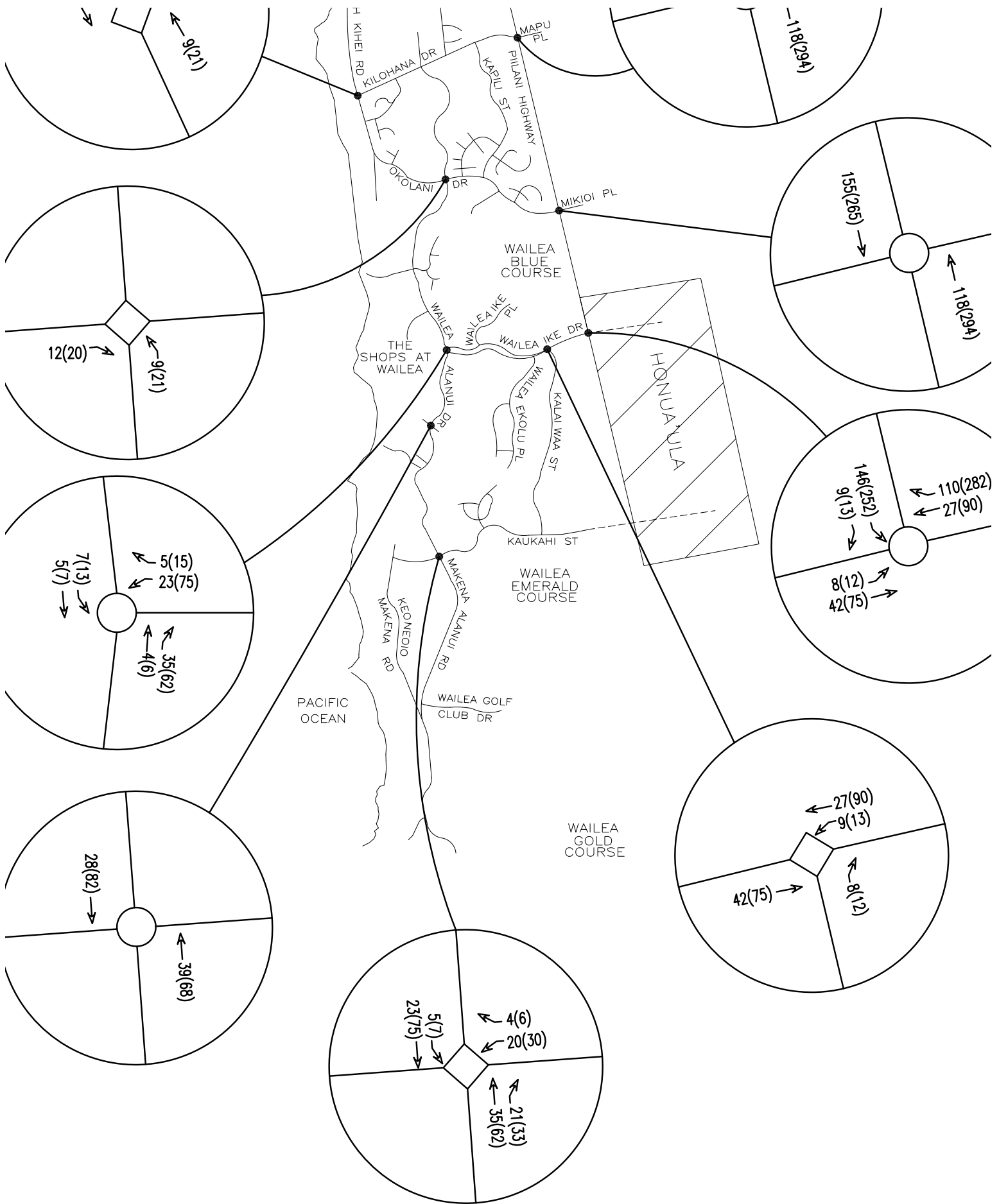
HONUA'ULA

ATA AUSTIN, TSUTSUMI & ASSOCIATES, INC.
ENGINEERS, SURVEYORS HONOLULU, HAWAII

FIGURE

GENERAL TRIP DISTRIBUTION PATTERN

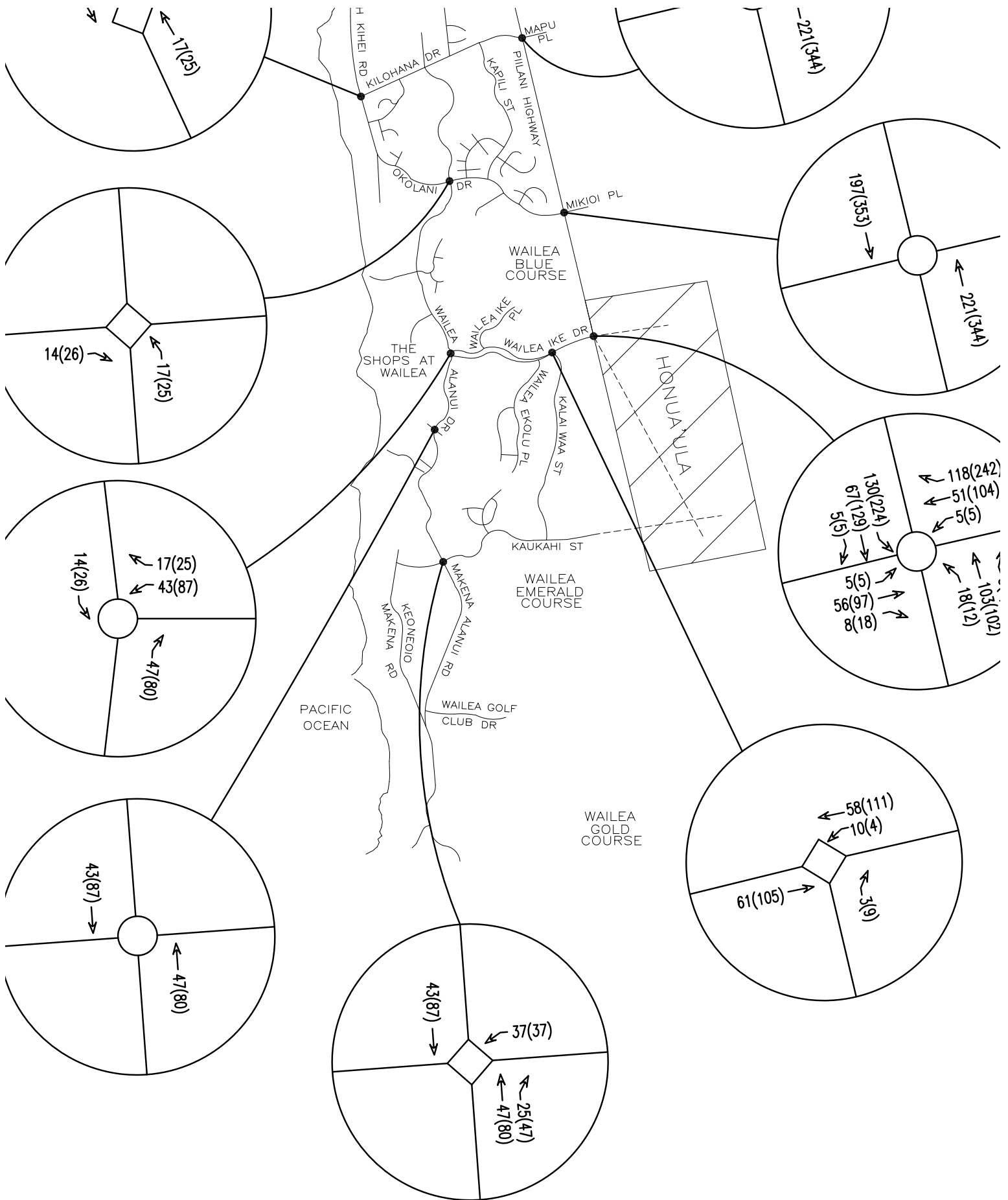
8



LEGEND:

##(##) - AM(PM) PEAK HOUR OF TRAFFIC VOL

◊ - UNSIGNALIZED INTERSECTION

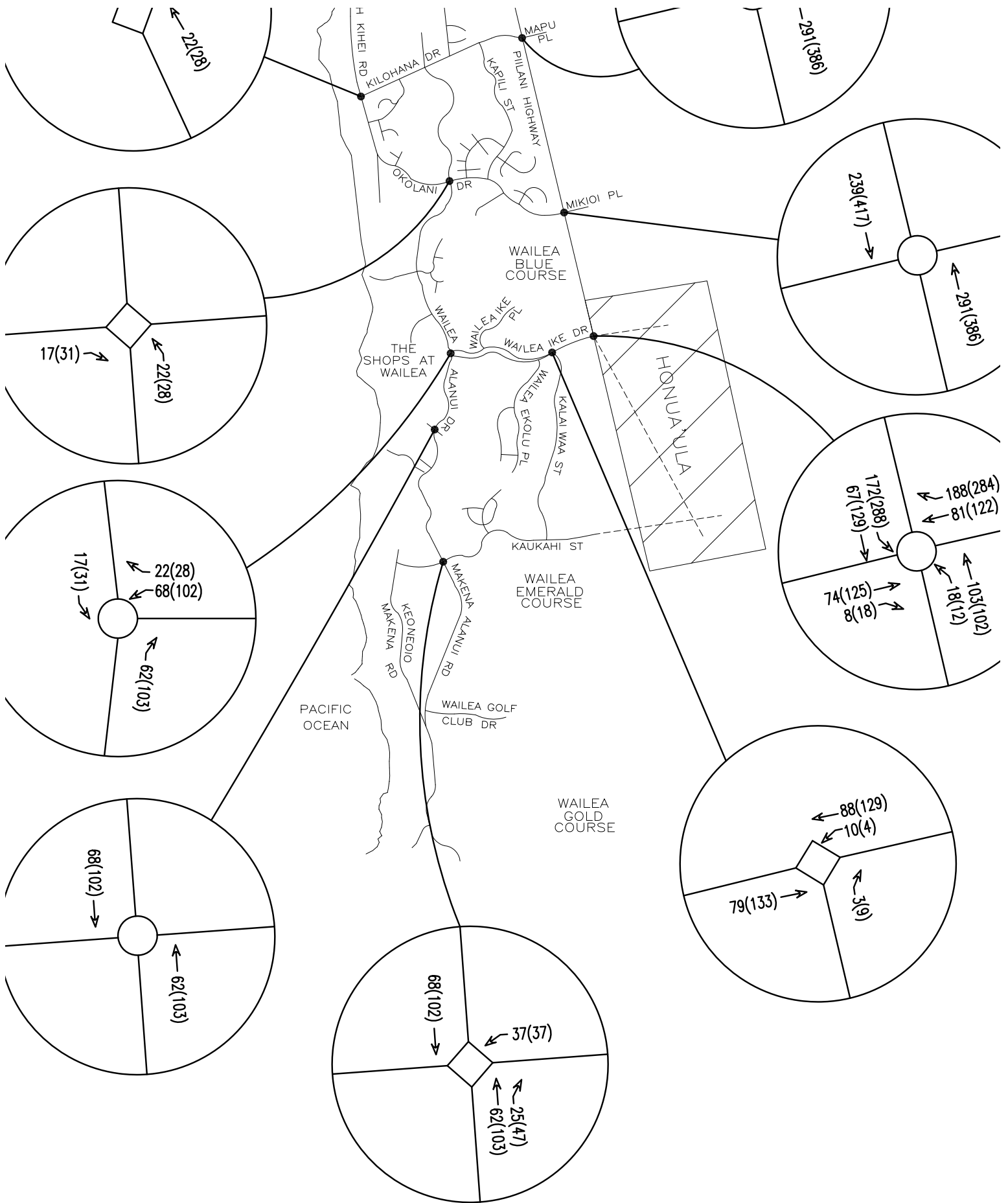


LEGEND:

##(##) - AM(PM) PEAK HOUR OF TRAFFIC VOL

◊ - UNSIGNALIZED INTERSECTION





LEGEND:

##(##) - AM(PM) PEAK HOUR OF TRAFFIC VOL

◊ - UNSIGNALIZED INTERSECTION





C. Zoning Conditions for the Project

In accordance with the Zoning Conditions for the Project, the following roadway improvements will be implemented prior to construction or occupancy of the Project:

- Piilani Highway will be widened to four (4) lanes as recommended in Section III.D. of this report. The widening of Piilani Highway is required without the Project.
- As stated in the Zoning Conditions for the Project, *“Modify the Wailea Alanui Drive/Wailea Ike Drive intersection to add a signalized double right-turn movement from northbound to eastbound turning traffic and provide two left-turn lanes for southbound traffic from Wailea Ike Drive prior to occupancy of the first unit in Kihei-Makena Project District 9.”*

Additionally, when warranted, a traffic signal system will be constructed at the Wailea Ike Drive/Kalai Waa Street and Wailea Alanui Drive/Kaukahi Street intersections in conjunction with the Makena Resort. Therefore, traffic signal warrants at the Wailea Ike Drive/Kalai Waa Street and Wailea Alanui Drive/Kaukahi Drive/Kaukahi Street intersections will be studied.

D. Future Year 2016 WITH Project Traffic and Analysis

Traffic generated by the Project was added to the Base Year 2016 traffic volumes to estimate traffic volumes for Future Year 2016 with the Project. The analysis of traffic conditions for Future Year 2016 assumed the mitigative measures recommended for Base Year 2016 and the Zoning Conditions for the Project to be implemented.

Intersections along Piilani Highway (WITH Project)

With completion of Phase I of the Project, the east leg of the Piilani Highway/Wailea Ike Drive intersection will be constructed forming a “tee”-intersection, with Piilani Highway being the stem of the tee. Due to a high southbound right-turn (1210 and 880 during the AM and PM peak hour of traffic, respectively) and eastbound left-turn (525 and 1305 during the AM and PM peak



hour of traffic, respectively) the following is recommended with Piilani Highway/Wailea Ike Drive intersection reconstructed to a “tee”-intersection:

- With projected traffic volumes, the intersection will warrant a traffic signal.
- Southbound approach: Provide an exclusive left-turn lane and an exclusive right-turn lane. Allow the Piilani Highway southbound right-turn to be a free turning movement by providing an exclusive westbound receiving lane on Wailea Ike Drive.
- Eastbound approach: Provide two (2) exclusive left-turn lanes (with a protected left-turn signal phase) and an exclusive through lane.
- Westbound Approach: Provide an exclusive through lane, and an exclusive right-turn lane.

With the lane configuration recommended above, the Piilani Highway/Wailea Ike Drive intersection will operate at LOS D or better during the AM and PM peak hours of traffic. All other intersections will continue to operate at LOS D or better during the AM and PM peak hours of traffic.

Wailea Ike Drive/Kalai Waa Street Intersection (WITH Project)

The Wailea Ike Drive/Kalai Waa Street intersection northbound left-turn movement will operate at LOS F during the AM and PM peak hours traffic. With projected volumes at both intersections most likely will not warrant a traffic signal. All other movements will operate at LOS D or better during the AM and PM peak hours of traffic.

South Kihei Road/Kilohana Drive Intersection (WITH Project)

The South Kihei Road/Kilohana Drive intersection will continue to operate at LOS C or better during both the AM and PM peak hours of traffic.

Intersections along Wailea Alanui Drive (WITH Project)

The Wailea Alanui Drive/Kaukahi Street intersection eastbound left-turn and the westbound left-turn movement will operate at LOS F during the PM peak hour of traffic. With projected volumes at the intersections most likely will not



warrant a traffic signal. All other movements will operate at LOS D or better during the AM and PM peak hours of traffic.

All other intersections along Wailea Alanui Drive will continue to operate at LOS D or better during both the AM and PM peak hours of traffic.

Figure 12 shows the traffic volumes and LOS at the study intersections for Future Year 2016. Appendix D shows the level-of-service table summary at all the study intersections and Appendix E shows the recommended lane configuration.

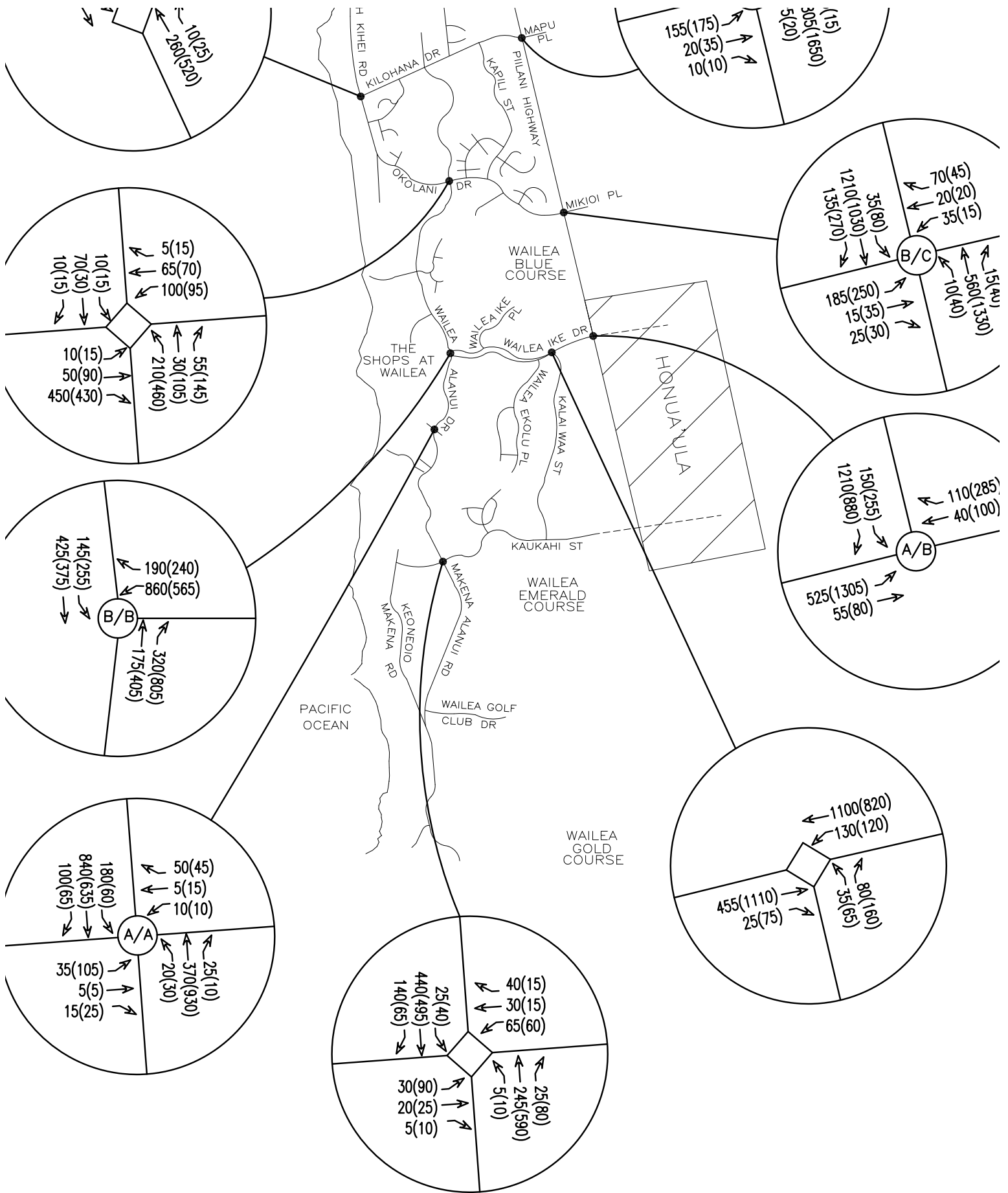
E. Future Year 2018 WITH Project Traffic and Analysis

Traffic generated by the Project was added to the Base Year 2018 traffic volumes to estimate traffic volumes for Future Year 2018 with the Project. The analysis of traffic conditions for Future Year 2018 assumed the mitigative measures recommended for Base Year 2016 and Future Year 2016 to be implemented.

Intersections along Piilani Highway (WITH Project)

The eastbound left-turn and southbound left-turn movements at the Piilani Highway/Kilohana Drive/Mapu Place intersection will operate at LOS E during the PM peak hour of traffic.

Providing additional capacity for the eastbound left-turn movement (double eastbound left-turn lanes) requires improvements to provide an exclusive westbound left-turn lane and a protected left-turn signal phase (8-phase signal cycle) for the eastbound and westbound left-turn movements. However, even if an additional signal phase is introduced, the eastbound approach will still continue to operate at LOS E conditions. If a split phase (6-signal phase) is provided for the eastbound and westbound approaches, the eastbound approach will still continue to operate at LOS E conditions.



LEGEND:

##(##) – AM(PM) PEAK HOUR OF TRAFFIC VOL

◊ – UNSIGNALIZED INTERSECTION





The Piilani Highway/Kilohana Drive/Mapu Place intersection serves as the northern access point to the Maui Meadows subdivision which is comprised of single-family homes. As mentioned above, during the PM peak hour of traffic, the southbound left-turn movement will operate at LOS E conditions. By providing double southbound left-turn lanes, all movements will operate at LOS D or better during the PM peak hour of traffic. However, the Highway Capacity Manual (HCM) recommends that double left-turn lanes be provided where the left-turn volume exceeds 300 vehicles during the peak hour, and at the Piilani Highway/Kilohana Drive/Mapu Place intersection, only approximately 50 vehicles and 160 vehicles will utilize the southbound left-turn movement during the AM and PM peak hour of traffic, respectively. Additionally, some vehicles may opt to utilize the southbound left-turn at Piilani Highway/Okolani Drive/Mikioi Place intersection, rather than Piilani Highway/Kilohana Drive/Mapu Place, since it will also be signalized. Therefore, additional improvements are not recommended at the Piilani Highway/Kilohana Drive/Mapu Place intersection.

With completion of Phase II of the Project, Piilani Highway will be extended to intersect with an extension of Kaukahi Street, forming a cross intersection at its intersection with Wailea Ike Drive. With Piilani Highway/Wailea Ike Drive intersection reconstructed to a cross-intersection, the following are the recommended lane configuration and is in accordance with the Zoning Conditions for the Project:

- Northbound Approach: Provide an exclusive left-turn lane (with a protected left-turn signal phase), two (2) exclusive through lanes, and an exclusive right-turn lane.
- Southbound Approaches: Provide two (2) exclusive left-turn lanes (with a protected left-turn signal phase), an exclusive through lane, and an exclusive right-turn lane. Also, it is recommended that the Piilani Highway southbound right-turn to be a free turning movement by providing an exclusive westbound receiving lane on Wailea Ike Drive. It is projected that a higher volume will be utilizing the southbound left-turn movement (175 vehicles and 290 vehicles during the AM and PM peak hours of traffic, respectively)



as opposed to the southbound through movement (70 vehicles and 130 vehicles during the AM and PM peak hours of traffic, respectively) during the AM and PM peak hours of traffic due to the layout of the Honuaula Project. Additionally, the HCM recommends that double left-turn lanes be provided where the left-turn volume exceeds 300 vehicles during the peak hour

- Eastbound Approach: Provide two (2) exclusive left-turn lanes (with a protected left-turn signal phase) and a shared through/right-turn lane.
- Westbound Approach: Provide an exclusive left-turn lane (with a protected left-turn signal phase), an exclusive through lane, and an exclusive right-turn lane.

The Piilani Highway/Okolani Drive intersection will continue to operate at LOS D or better during the AM and PM peak hours of traffic.

Wailea Ike Drive/Kalai Waa Street Intersection

The Wailea Ike Drive/Kalai Waa Street intersection northbound left-turn movement will continue to operate at LOS F during the AM and PM peak hours of traffic. The northbound right-turn will operate at LOS E during the PM peak hour of traffic. With projected volumes at the intersection most likely will not warrant a traffic signal.

South Kihei Road/Kilohana Drive Intersection

The South Kihei Road/Kilohana Drive intersection will continue to operate at LOS C or better during both the AM and PM peak hours of traffic.

Intersections along Wailea Alanui Drive

The northbound left-turn movement at the intersection of Wailea Alanui Drive/Okolani Drive will continue to operate at LOS E during the PM peak hour of traffic. Projected volumes at this intersection most likely will not warrant a traffic signal system. During the AM peak hour of traffic, all movements will continue to operate at LOS D or better.



The Wailea Alanui Drive/Kaukahi Street intersection eastbound left-turn and the westbound left-turn movements will continue to operate at LOS F during the PM peak hour of traffic. With projected volumes at the intersection most likely will not warrant a traffic signal. During the AM peak hour of traffic, all other movements will continue to operate at LOS D or better.

All other intersections along Wailea Alanui Drive will continue to operate at LOS D or better during both the AM and PM peak hours of traffic.

Figure 13 shows the traffic volumes and LOS at the study intersections for Future Year 2018 with mitigative measures. Appendix D shows the level-of-service table summary at all the study intersections and Appendix E shows the recommended lane configuration.

F. Future Year 2022 WITH Project Traffic and Analysis

Traffic generated by the Project was added to the Base Year 2022 traffic volumes to estimate traffic volumes for Future Year 2022 with the Project. The analysis of traffic conditions for Future Year 2022 assumed the mitigative measures recommended for Base Year 2016 and Future Year 2016 and 2018 to be implemented.

Intersections along Piilani Highway

The eastbound left-turn and southbound left-turn movements at the Piilani Highway/Kilohana Drive/Mapu Place intersection will continue to operate at LOS E during the PM peak hour of traffic. However, all other movements will continue to operate at LOS D or better during the AM and PM peak hours of traffic.

All other intersections along Piilani Highway will continue to operate at LOS D or better during the AM and PM peak hours of traffic.



Wailea Ike Drive/Kalai Waa Street Intersection

The Wailea Ike Drive/Kalai Waa Street intersection northbound left-turn movement will continue to operate at LOS F during the AM and PM peak hours of traffic. The northbound right-turn will continue to operate at LOS F during the PM peak hour of traffic. However, projected volumes at the intersection most likely will not warrant a traffic signal. All other movements will continue to operate at LOS D or better during the AM and PM peak hours of traffic.

South Kihei Road/Kilohana Drive Intersection

The South Kihei Road/Kilohana Drive intersection will continue to operate at LOS C or better during both the AM and PM peak hours of traffic.

Intersections along Wailea Alanui Drive

The northbound left-turn movement at the intersection of Wailea Alanui Drive/Okolani Drive will continue to operate at LOS F during the PM peak hour of traffic. Projected volumes at this intersection most likely will not warrant a traffic signal system. During the AM peak hour of traffic, all movements will continue to operate at LOS D or better.

The Wailea Alanui Drive/Kaukahi Street intersection westbound left-turn and eastbound left-turn will continue to operate at LOS F and the eastbound through/right-turn will operate at LOS E during the PM peak hour of traffic. The eastbound left-turn movement will operate at LOS F during the AM peak hour of traffic. With projected traffic volumes, a traffic signal system will most likely be warranted. However, due to the current condition of the Makena Resort development it is unknown if the land use assumed in Section III.B. is accurate, therefore, a traffic signal warrant should be evaluated in the future as projects become developed. As a signalized intersection, the intersection will operate at LOS C or better during the AM and PM peak hours of traffic.

All other intersections along Wailea Alanui Drive will continue to operate at LOS D or better during the AM and PM peak hours of traffic.

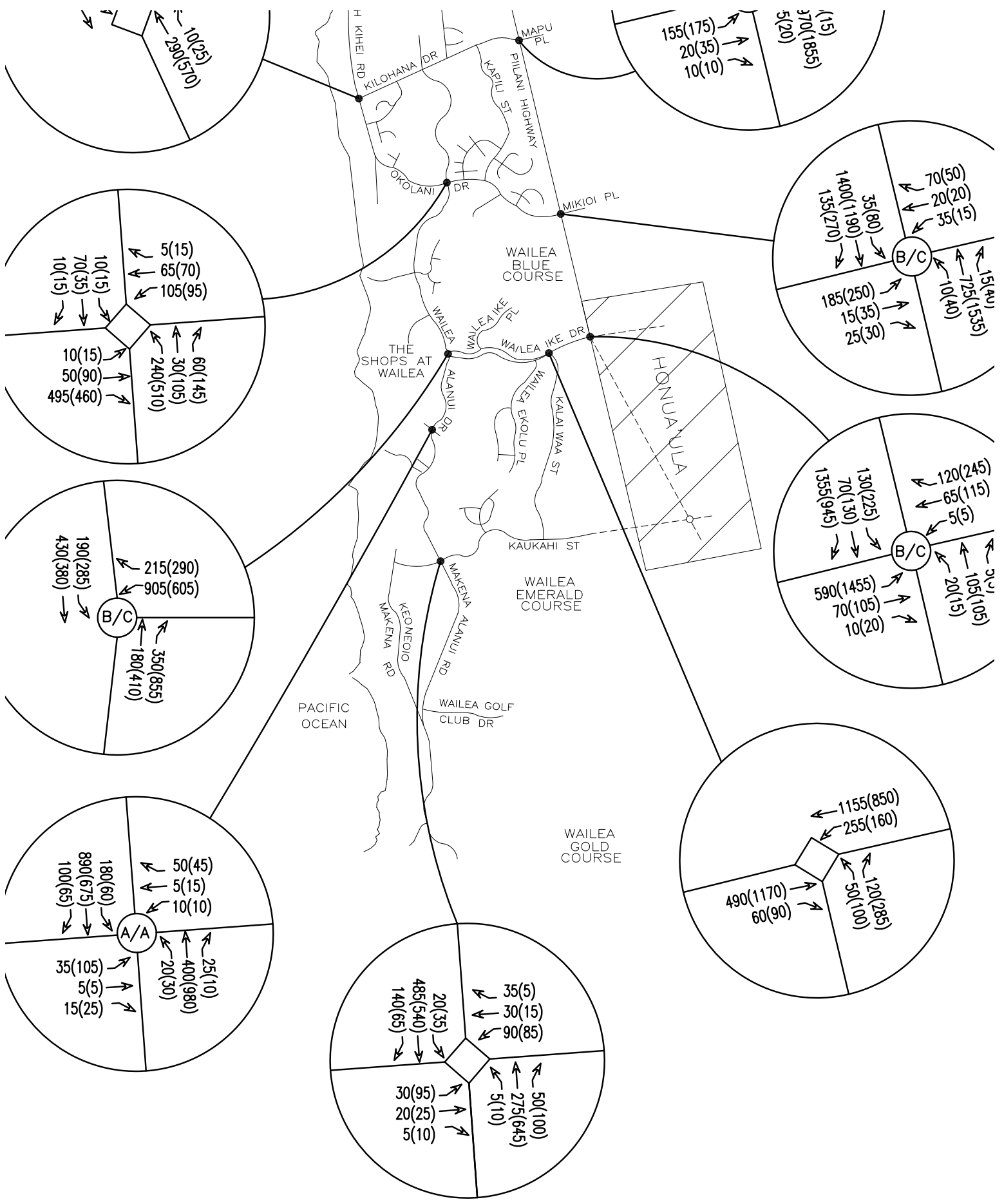
Figure 14 shows the traffic volumes and LOS at the study intersections for Future Year with mitigative measures. Appendix D shows the level-of-service



table summary at all the study intersections and Appendix E shows the recommended lane configuration.

G. Modern Roundabouts

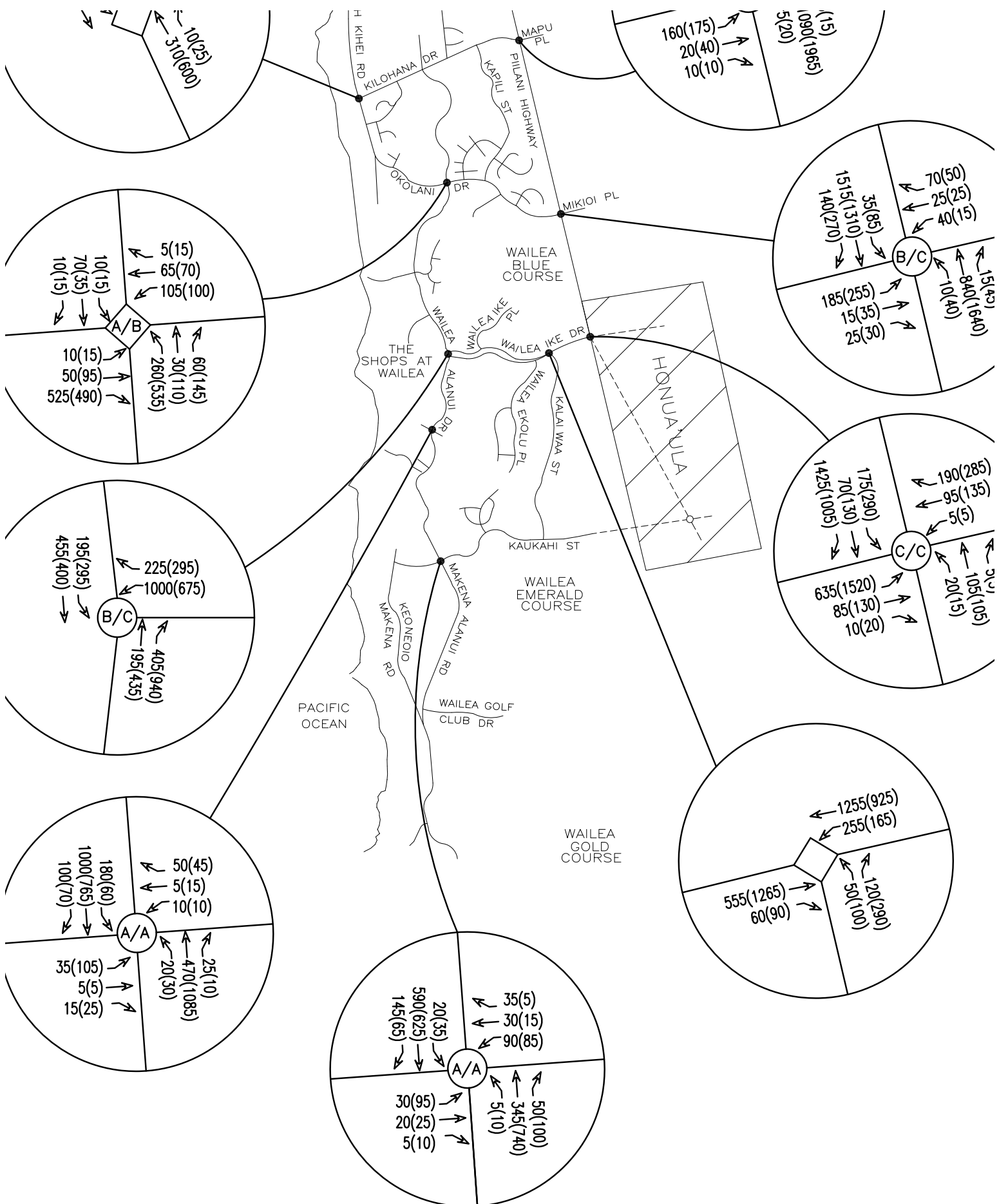
Due to zoning conditions and Special Management Area conditions, the Piilani Highway/Kilohana Drive/Mapu Place, Piilani Highway/Okolani Drive/Mikioi Place, Piilani Highway/Wailea Ike Drive intersections are conditioned to be signalized intersections. Additionally, at the Wailea Ike Drive/Kalai Waa Street and Wailea Alanui Drive/Kaukahi Street intersections are conditioned to be signalized intersections when warranted. Therefore, the option of modern roundabouts is not studied.



LEGEND:

##(##) - AM(PM) PEAK HOUR OF TRAFFIC VOL
 ◇ - UNSIGNALIZED INTERSECTION





LEGEND:

- ##(##) – AM(PM) PEAK HOUR OF TRAFFIC VOL
- ◊ – UNSIGNALIZED INTERSECTION





V. PROPOSED PROJECT ACCESSES ALONG PIILANI HIGHWAY EXTENSION

A. Project Access Description

Phase II of the Project proposes to extend Piilani Highway further south. The Piilani Highway Extension will narrow to a two-lane roadway south of its intersection with Wailea Ike Drive and provide five (5) intersections to the Project. The following are the proposed intersections along the Piilani Highway Extension:

Piilani Highway Extension/North Access intersection is the first access south of the Piilani Highway/Wailea Ike Drive intersection. The Piilani Highway Extension/North Access forms a “tee”-intersection, with the North Access being the stem of the tee. The North Access is proposed to provide access to approximately 80 multi-family units located on the west side of the Piilani Highway Extension.

Piilani Highway Extension/Fire Station Driveway Intersection is the second access south of the Piilani Highway/Wailea Ike Drive intersection. The Piilani Highway Extension/Fire Station Driveway forms a “tee”-intersection, with the Fire Station Driveway being the stem of the tee. The Fire Station Driveway is proposed to provide access to the Fire Station only which is proposed to be located on the east side of the Piilani Highway Extension.

Piilani Highway Extension/Mid Access Intersection is the third access south of the Piilani Highway/Wailea Ike Drive intersection. The Piilani Highway Extension/Mid Access forms a “tee”-intersection, with the Mid Access being the stem of the tee. The Mid Access is proposed to provide access to approximately 68 multi-family units located on the west side of the Piilani Highway Extension.

Piilani Highway Extension/Kaukahi Drive Extension Intersection is the fourth access south of the Piilani Highway/Wailea Ike Drive intersection. The Piilani Highway Extension/Kaukahi Drive Extension forms a “tee”-intersection, with Kaukahi Drive Extension being the stem of the tee. The Kaukahi Street Extension will connect to the existing Kaukahi Street and provide access to the Project’s residential units and golf clubhouse area.



Piilani Highway Extension/South Access Intersection is the fifth and last access south of the Piilani Highway/Wailea Ike Drive intersection. The Piilani Highway Extension/South Access forms a cross intersection. To the east, the South Access will provide a roadway connection, within the Project's development, to the east leg of the Piilani Highway/Wailea Ike Drive intersection. To the west, the South Access will provide access to the Project's multi-family housing, and golf clubhouse. To the south, the Piilani Highway Extension will provide a roadway connection within the Project's development along connecting to the east leg of the Piilani Highway/Wailea Ike Drive intersection.

B. Traffic Volumes and Analyses

The Project access intersections along the Piilani Highway Extension were studied as unsignalized intersections and as a roundabout. Table 7 shows the LOS at the Project access intersections as a single lane roundabout and with the following lane configuration as unsignalized intersections:

Piilani Highway Extension/North Access Intersection:

- Northbound Approach: Provide an exclusive left-turn lane and an exclusive through lane.
- Southbound Approach: Provide a shared through/right-turn lane.
- Eastbound Approach: Provide a shared left-turn/right-turn lane. The eastbound approach shall be the stop-controlled approach.

Piilani Highway Extension/Fire Station Driveway Intersection:

- Northbound Approach: Provide a shared through/right-turn lane.
- Southbound Approach: Provide an exclusive left-turn lane and an exclusive through lane.
- Westbound Approach: Provide a shared left-turn/right-turn lane. The westbound approach shall be the stop-controlled approach.

Piilani Highway Extension/Mid Access Intersection:

- Northbound Approach: Provide an exclusive left-turn lane and an exclusive through lane.



- Southbound Approach: Provide a shared through/right-turn lane.
- Eastbound Approach: Provide a shared left-turn/right-turn lane. The eastbound approach shall be the stop-controlled approach.

Piilani Highway Extension/Kaukahi Drive Extension:

- Northbound Approach: Provide an exclusive left-turn lane and an exclusive through lane.
- Southbound Approach: Provide a shared through/right-turn lane.
- Eastbound Approach: Provide a shared left-turn/right-turn lane. The eastbound approach shall be the stop-controlled approach.

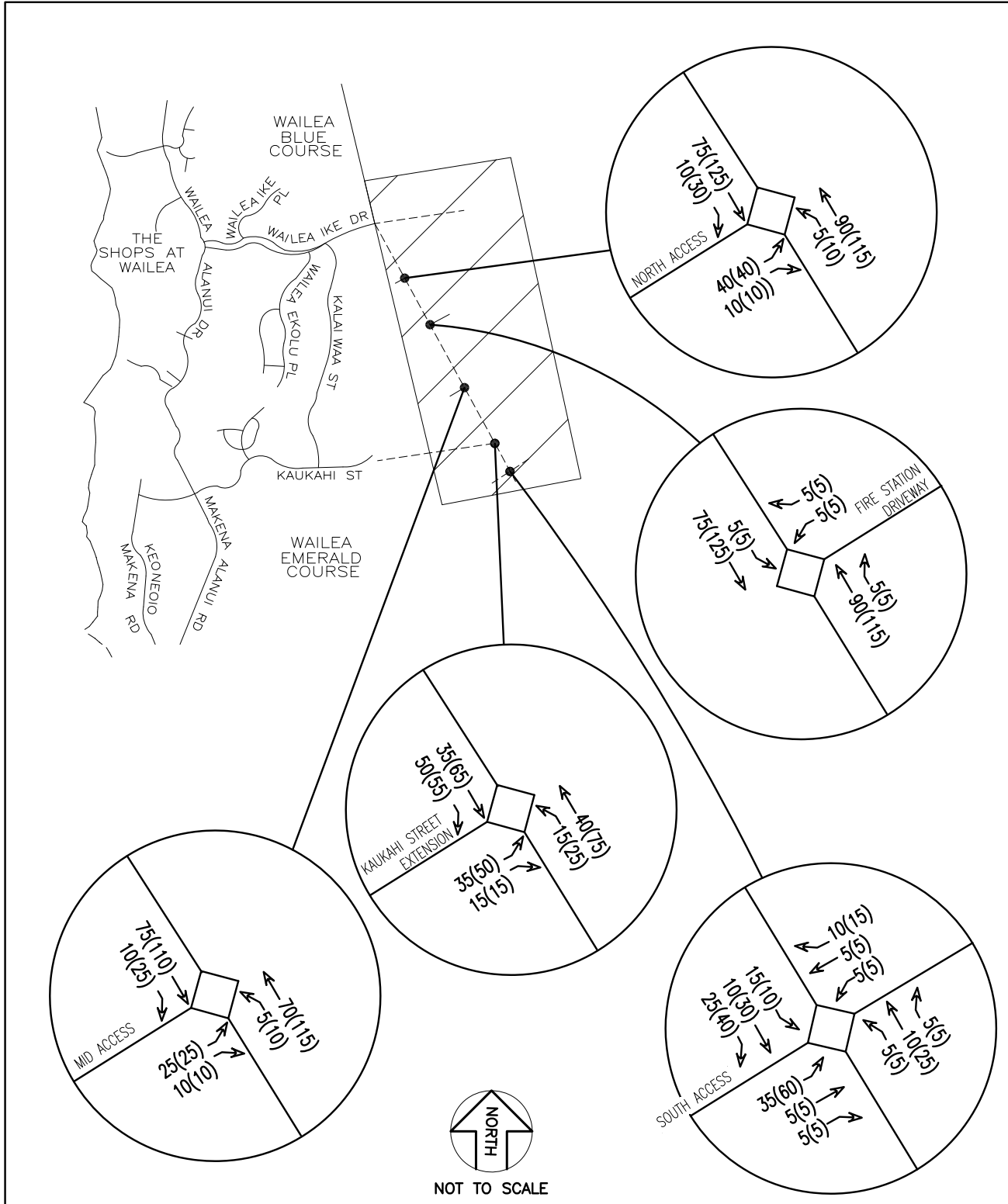
Piilani Highway Extension/South Access:

- Northbound and Southbound Approach: Provide an exclusive left-turn lane and a shared through/right-turn lane.
- Eastbound and Westbound Approach: Provide a shared left-turn/through/right-turn lane. The westbound approach shall be the stop-controlled approach.

Analyses show that the intersections along the Piilani Highway Extension will operate at LOS A during the AM and PM peak hours of traffic as an unsignalized intersection and a single lane roundabout. Since the Piilani Highway Extension is a long stretch of roadway - with no traffic signals warranted at the proposed intersections - there is a possibility that speeding could occur. Therefore, single lane roundabouts were studied which are traffic calming devices, reducing the potential speeding of vehicles.

Figure 15 shows the Future Year 2022 proposed Project intersection traffic volumes and level of service.

Table 7 LOS Summary for Project Access Intersections (FY 2022)												
Intersection	UN SIGNALIZED INTERSECTION						ROUNDABOUT					
	AM			PM			AM			PM		
	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS
Piliani Highway Extension & North Access												
EB LT/RT	9.7	0.07	A	10.4	0.08	B	3.6	--	A	3.6	--	B
NB LT	7.4	0	A	7.6	0.01	A	4.2	-	A	4.2	--	A
NB TH	0	0.06	A	0	0.07	A	0	-	A	0	-	A
SB TH/RT	0	0.05	A	0	0.1	A	4.2	--	A	4.2	--	A
Overall	2.3	-	A	1.8	-	A	3.2	--	A	3.4	--	A
Piliani Highway Extension & Fire Station Driveway												
WB LT/RT	9.2	0.01	A	9.6	0.01	A	3.6	-	A	3.6	--	A
NB TH/RT	0	0.06	A	0	0.08	A	4.2	-	A	4.2	--	A
SB LT	7.4	0	A	7.5	0	A	4.2	-	A	4.2	--	A
SB TH	0	0.05	A	0	0.08	A	0	-	A	0	-	A
Overall	0.7	-	A	0.5	-	A	3.2	-	A	3.4	--	A
Piliani Highway Extension & Mid Access												
EB LT/RT	9.4	0.04	A	10	0.05	A	3.6	-	A	3.6	--	A
NB LT	7.4	0	A	7.5	0.01	A	4.2	-	A	4.2	--	A
NB TH	0	0.04	A	0	0.07	A	0	-	A	0	-	A
SB TH/RT	0	0.05	A	0	0.09	A	4.2	-	A	4.2	--	A
Overall	1.9	-	A	1.4	-	A	3.2	-	A	3.4	--	A
Piliani Highway Extension & Kauhahi Drive Extension												
EB LT/RT	9.3	0.06	A	10.1	0.09	A	3.6	-	A	3.6	--	A
NB LT	7.4	0.01	A	7.5	0.02	A	4.2	-	A	4.2	--	A
NB TH	0	0.03	A	0	0.05	A	0	-	A	0	-	A
SB TH/RT	0	0.05	A	0	0.08	A	4.2	-	A	4.2	--	A
Overall	3	-	A	3	-	A	3.2	-	A	3.4	--	A
Piliani Highway Extension & South Access												
EB LT/TH/RT	9.3	0.06	A	9.8	0.09	A	3.6	-	A	4.2	-	A
WB LT/TH/RT	8.9	0.02	A	9	0.03	A	3.6	-	A	4.2	-	A
NB LT	7.3	0	A	7.4	0	A	3.6	-	A	3.6	-	A
NB TH/RT	0	0.01	A	0	0.02	A	0	-	A	0	-	A
SB LT	7.3	0.01	A	7.3	0.01	A	4.2	-	A	4.2	-	A
SB TH/RT	0	0.02	A	0	0.04	A	0	-	A	0	-	A
Overall	5.5	-	A	4.9	-	A	3.1	-	A	3.2	-	A



HONU'A'ULA

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YEAR 2022 PROJECT INTERSECTION TRAFFIC VOLUMES AND LEVEL OF SERVICE

FIGURE
15



VI. SUMMARY AND RECOMMENDATIONS

A. Summary

Existing Conditions

The general paths vehicles utilize when traveling between areas north of Wailea and south in Makena are Piilani Highway, Wailea Ike Drive, and Wailea Alanui Drive.

The eastbound approach at the Piilani Highway/Okolani Drive/Mikioi Place intersections experience minimal gaps between vehicles traveling along Piilani Highway. However, as a condition for the development of the Kai Malu Project (MF-8) within the Wailea Resort, the Piilani Highway/Okolani Drive/Mikioi Place intersection will be signalized and the eastbound approach will be restriped to provide an exclusive left-turn lane and a shared through/right-turn lane.

Base Years WITHOUT the Project

For the purpose of this study Phase I of the Project is anticipated to be completed by Year 2016, Phase II by Year 2018, and Phase III by Year 2022. Therefore, traffic volume projections were determined for these three years (without project) using an annual vehicular de facto growth rate of 0.5 percent and including other known developments such as the Wailea Resort and Makena Resort projects. The improvements to Piilani Highway/Okolani Drive/Mikioi Place, as a result of the Kai Mahi Project (MF-8), are assumed to be completed by Year 2016.

Analysis of Base Year 2016 traffic conditions without the project indicates that some individual movements at the Piilani Highway/Kilohana Drive/Mapu Place intersection will operate at LOS F during the AM and PM peak hours of traffic. Widening of Piilani Highway to four-lanes between its intersection with Kilohana Drive/Mapu Place and Wailea Ike Drive is required, even without the Project. With widening of Piilani Highway, the Piilani Highway/Kilohana Drive/Mapu Place and Piilani Highway/Okolani Drive/Mikioi Place intersection will operate at LOS D or better during both the AM and PM peak hours of traffic. Base Year 2018 and 2022 traffic conditions at intersections along Piilani Highway



will continue to operate at LOS D or better during both the AM and PM peak hours of traffic.

With Base Year 2016, 2018, and 2022 projected traffic volumes, the stop-controlled approaches at the unsignalized intersections of Wailea Ike Drive/Kalai Waa Street and Wailea Alanui Drive/Kaukahi Drive will operate at LOS E or LOS F. However, in accordance with the HCM, projected volumes at both intersections do not warrant a traffic signal system. A roundabout was not studied at these intersections since Zoning Conditions for the Project require a traffic signal system when warranted.

The northbound left-turn movement at the all-way stop-controlled intersection of Wailea Alanui Drive/Okolani Drive will operate at LOS E with Base Year 2018 projected traffic volumes and LOS F with Base Year 2022 projected traffic volumes. A roundabout was studied at this intersection, however, in accordance with the U.S. Federal Highway Administration roundabout guidelines, a roundabout is not desirable where grades are greater than 4 percent. It appears that Okolani Drive is greater than 4 percent near its intersection with Wailea Alanui Drive.

Future Years WITH the Project

Phase I (anticipated completion Year 2016) of the Project will include approximately 26,000 square feet of Office Space, 74,000 square feet of Commercial Space, 75 Multi-Family Affordable units, 158 Multi-Family Market Rate Units, 40 Multi-Family Townhouse units, and 127 Single-Family units. Additionally, Phase I will also include construction of the east leg of the Piilani Highway/Wailea Ike Drive intersection, forming a “tee”-intersection and the extension of Kaukahi Street to intersect with the Piilani Highway Extension. Since Kaukahi Street is a private road, it is planned to be a gated access within the Project to address the concerns of current owners along Kaukahi Street.

Phase II (anticipated completion Year 2018) of the Project will include approximately 200 Multi-Family Affordable units, 30 Multi-Family Market Rate Units, 60 Multi-Family Townhouse units, and 110 Single-Family units. Additionally, Phase II will also include the construction the south leg of the Piilani



Highway/Wailea Ike Drive intersection, forming a cross intersection and extend Piilani Highway to intersect with the Kaukahi Street Extension.

Phase III of the Project will include approximately 175 Multi-Family Affordable units, 12 Multi-Family Market Rate Units, and 163 Single-Family units.

The following are Zoning Conditions for the Project and will be completed prior to construction or occupancy of the Project:

- Widen Piilani Highway between Kilohana Drive/Mapu Place and Wailea Ike Drive to four (4) lanes; which is required for sufficient capacity without the Project.
- The Wailea Alanui Drive/Wailea Ike Drive intersection shall be modified to provide a second northbound right-turn lane (signalize the movement) and a second westbound left-turn lane.
- The Wailea Ike Drive/Kalai Waa Street and Wailea Alanui Drive/Kaukahi Street intersections shall be signalized when warranted. Therefore, signal warrants are studied at the Wailea Ike Drive/Kalai Waa Street and Wailea Alanui Drive/Kaukahi Street intersections.

With Future Year 2022 projected traffic volumes, the northbound left-turn movement at the unsignalized intersection of Wailea Ike Drive/Kalai Waa Street will continue to operate at LOS F. However, in accordance with the HCM, a traffic signal at the intersection is not warranted.

At the Wailea Alanui Drive/Kaukahi Street intersection, with Future Year 2022 projected traffic volumes, a traffic signal system will most likely be warranted. However, due to the current condition of the Makena Resort development it is unknown if the land use assumed in Section III.B. is accurate, therefore, a traffic signal warrant should be evaluated in the future as projects become developed. As a signalized intersection, the intersection will operate at LOS C or better during the AM and PM peak hours of traffic.



Proposed Project Accesses Along Piilani Highway Extension

The five (5) proposed accesses along the Piilani Highway Extension were studied as single lanes roundabout and unsignalized intersection. During the AM and PM peak hours of traffic, both the single lane roundabout and unsignalized intersection will operate at LOS A at all proposed project intersections along Piilani Highway Extension. Due to the length of Piilani Highway Extension – as well as no traffic signals warranted – there is a possibility that speeding could occur. Therefore, single lane roundabouts were studied which are traffic calming, reducing the potential speeding of vehicles.

B. Recommendations

1. WITHOUT the Project

The following are recommendations that would be needed **WITHOUT the Project**:

- **Year 2016 (WITHOUT the Project)** - Widen Piilani Highway to four-lanes from Kilohana Drive/Mapu Place to Wailea Ike Drive. The following are the recommended lane configurations at intersections along Piilani Highway:

Piilani Highway/Kilohana Drive/Mapu Place

- Northbound and Southbound Approaches: Provide an exclusive left-turn lane (with a protected left-turn signal phase), two (2) exclusive through lanes, and an exclusive right-turn lane.
- Eastbound Approach: Remain as an exclusive left-turn lane and a shared through/right-turn lane (with a permissive signal phase).
- Westbound Approach: Provide an exclusive left-turn lane, an exclusive through lane and an exclusive right-turn lane (with a permissive signal phase).



Piilani Highway/Okolani Drive/Mikioi Place

- Northbound and Southbound Approaches: Provide an exclusive left-turn lane (with a protected left-turn signal phase), an exclusive through lane, and a shared through/right-turn lane.
- Eastbound Approach: Provide an exclusive left-turn lane and a shared through/right-turn lane (with a permissive signal phase).
- Westbound Approach: Remain as a shared left-turn/through/right-turn lane (with a permissive signal phase).

Piilani Highway/Wailea Ike Drive

- Southbound Approach: Remain as an exclusive free right-turn lane.
 - Eastbound Approach: Remain as an exclusive free left-turn lane.
 - Northbound and Westbound Approaches will only be constructed with the Project.
- **Year 2016 (WITHOUT the Project)** - At the **Wailea Alanui Drive/Kaukahi Drive** intersection, provide the eastbound and westbound approach with an exclusive left-turn lane and a shared through/right-turn lane in conjunction with the Makena Resort.

2. WITH the Project

The following are recommendations of the traffic study that would be needed **WITH the Project** and are in accordance with the Zoning Conditions for the Project:

- **Year 2016 (WITH the Project)** - Provide the following lane configuration at the **Piilani Highway/Wailea Ike Drive** with completion of Phase I (anticipated completion Year 2016) of the Project:



- Signalize the intersection.
- Southbound approach: Provide an exclusive left-turn lane and an exclusive right-turn lane. Allow the Piilani Highway southbound right-turn to be a free turning movement by providing an exclusive westbound receiving lane on Wailea Ike Drive.
- Eastbound approach: Provide two (2) exclusive left-turn lanes (with a protected left-turn signal phase) and an exclusive through lane.
- Westbound Approach: Provide an exclusive through lane, and an exclusive right-turn lane.
- **Year 2016 (WITH the Project)** - Provide the following lane configuration at the **Wailea Alanui Drive/Wailea Ike Drive**:
 - Northbound Approach: Provide an exclusive through lane and two (2) exclusive right-turn lanes. Signalize the two (2) exclusive right-turn lanes.
 - Southbound Approach: Remain as an exclusive left-turn lane and two (2) exclusive through lanes.
 - Westbound Approach: Provide two (2) exclusive left-turn lanes and an exclusive right-turn lane.
- **Year 2018 (WITH the Project)** - Provide the following lane configuration at the **Piilani Highway/Wailea Ike Drive** with completion of Phase II (anticipated completion Year 2018) of the Project:
 - Northbound Approach: Provide an exclusive left-turn lane (with a protected left-turn signal phase), two (2) exclusive through lanes, and an exclusive right-turn lane.
 - Southbound Approaches: Provide two (2) exclusive left-turn lanes (with a protected left-turn signal phase), an exclusive through lane, and an exclusive right-turn lane.



Also, it is recommended that the Piilani Highway southbound right-turn to be a free turning movement by providing an exclusive westbound receiving lane on Wailea Ike Drive.

- Eastbound Approach: Provide two (2) exclusive left-turn lanes (with a protected left-turn signal phase) and a shared through/right-turn lane.
- Westbound Approach: Provide an exclusive left-turn lane (with a protected left-turn signal phase), an exclusive through lane, and an exclusive right-turn lane.
- **Year 2022 (WITH the Project)** – Perform a traffic signal warrant study as projects become developed and signalize the **Wailea Alanui Drive/Kaukahi Street** intersection, if warranted.

3. Proposed Project Intersections

It is recommended that the Piilani Highway Extension be a two (2) lane roadway south of its intersection with Wailea Ike Drive. It is recommended that the proposed project intersections be single lane roundabouts or unsignalized intersections. The following are the recommended lane configurations at the proposed Project accesses as unsignalized intersections:

Piilani Highway Extension/North Access Intersection:

- Northbound Approach: Provide an exclusive left-turn lane and an exclusive through lane.
- Southbound Approach: Provide a shared through/right-turn lane.
- Eastbound Approach: Provide a shared left-turn/right-turn lane. The eastbound approach shall be the stop-controlled approach.



Piilani Highway Extension/Fire Station Driveway Intersection:

- Northbound Approach: Provide a shared through/right-turn lane.
- Southbound Approach: Provide an exclusive left-turn lane and an exclusive through lane.
- Westbound Approach: Provide a shared left-turn/right-turn lane. The westbound approach shall be the stop-controlled approach.

Piilani Highway Extension/Mid Access Intersection:

- Northbound Approach: Provide an exclusive left-turn lane and an exclusive through lane.
- Southbound Approach: Provide a shared through/right-turn lane.
- Eastbound Approach: Provide a shared left-turn/right-turn lane. The eastbound approach shall be the stop-controlled approach.

Piilani Highway Extension/Kaukahi Drive Extension:

- Northbound Approach: Provide an exclusive left-turn lane and an exclusive through lane.
- Southbound Approach: Provide a shared through/right-turn lane.
- Eastbound Approach: Provide a shared left-turn/right-turn lane. The eastbound approach shall be the stop-controlled approach.

Piilani Highway Extension/South Access:

- Northbound and Southbound Approach: Provide an exclusive left-turn lane and a shared through/right-turn lane.
- Eastbound and Westbound Approach: Provide a shared left-turn/through/right-turn lane. The westbound approach shall be the stop-controlled approach.



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5. Transportation Research Board, Highway Capacity Manual, 2000.
6. Wilson Okamoto Corporation, Traffic Impact Report for the Grand Wailea Resort Renovation, January 2009.



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APPENDICES



AUSTIN, TSUTSUMI & ASSOCIATES, INC.
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APPENDIX A

TRAFFIC COUNT DATA

Austin, Tsutsumi & Associates

501 Sumner Street, Suite 521

Honolulu, HI 96817

Phone: 533-3646 Fax: 526-1267

Piilani - Kilohana AM
AM Peak Hour

File Name : Piilani - Kilohana AM
Site Code : 00000000
Start Date : 6/25/2008
Page No : 1

Groups Printed- Unshifted

Start Time	Piilani From North				Kilohana From East				Piilani From South				Kilohana From West				Int. Total
	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	
06:30	18	155	4	0	28	2	0	0	0	73	1	4	0	1	11	2	299
06:45	17	169	11	0	29	3	2	0	0	53	0	2	2	5	15	1	309
Total	35	324	15	0	57	5	2	0	0	126	1	6	2	6	26	3	608
07:00	30	166	6	0	39	8	3	0	2	71	1	3	2	1	9	1	342
07:15	30	198	10	0	35	7	1	0	0	76	1	0	2	5	19	0	384
07:30	21	208	11	0	35	5	3	1	0	67	0	2	1	3	23	1	381
07:45	31	208	22	0	36	4	4	0	1	77	0	0	2	6	15	0	406
Total	112	780	49	0	145	24	11	1	3	291	2	5	7	15	66	2	1513
08:00	23	153	9	0	38	1	1	1	0	67	1	1	1	4	18	0	318
08:15	13	135	23	0	39	7	3	0	3	68	0	1	3	12	21	0	328
Grand Total	183	1392	96	0	279	37	17	2	6	552	4	13	13	37	131	5	2767
Apprch %	11	83.3	5.7	0	83.3	11	5.1	0.6	1	96	0.7	2.3	7	19.9	70.4	2.7	
Total %	6.6	50.3	3.5	0	10.1	1.3	0.6	0.1	0.2	19.9	0.1	0.5	0.5	1.3	4.7	0.2	

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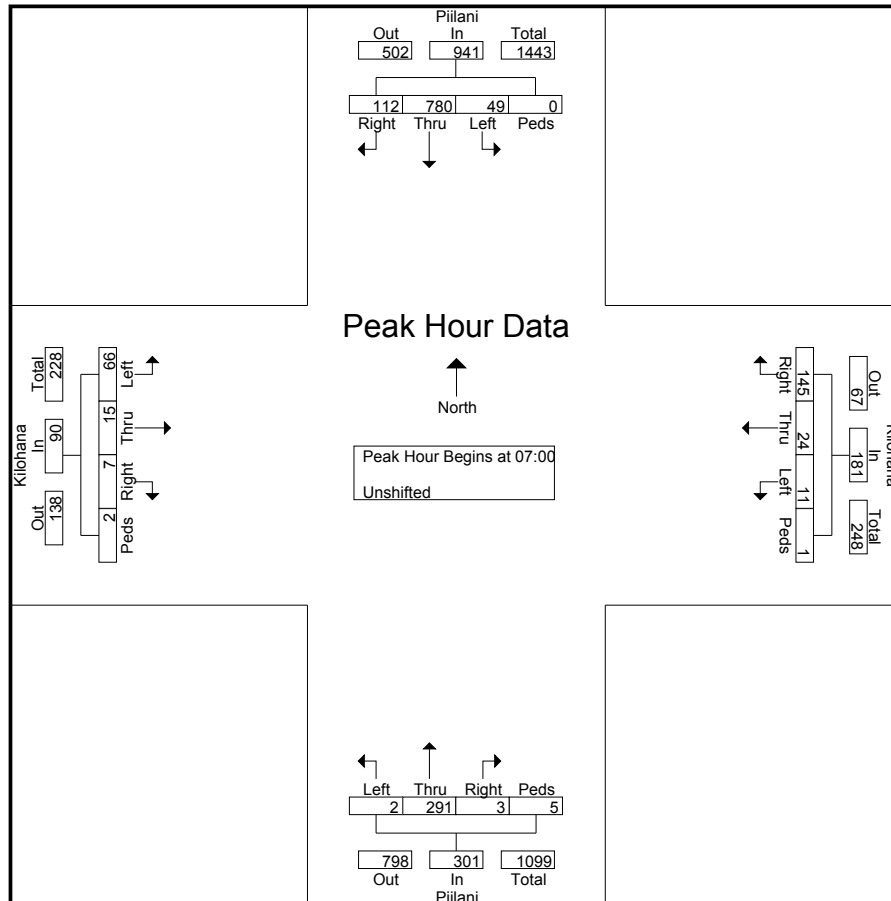
File Name : Piilani - Kilohana AM

Site Code : 00000000

Start Date : 6/25/2008

Page No : 2

Start Time	Piilani From North					Kilohana From East					Piilani From South					Kilohana From West					Int. Total
	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	
Peak Hour Analysis From 07:00 to 07:45 - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:00																					
07:00	30	166	6	0	202	39	8	3	0	50	2	71	1	3	77	2	1	9	1	13	342
07:15	30	198	10	0	238	35	7	1	0	43	0	76	1	0	77	2	5	19	0	26	384
07:30	21	208	11	0	240	35	5	3	1	44	0	67	0	2	69	1	3	23	1	28	381
07:45	31	208	22	0	261	36	4	4	0	44	1	77	0	0	78	2	6	15	0	23	406
Total Volume	112	780	49	0	941	145	24	11	1	181	3	291	2	5	301	7	15	66	2	90	1513
% App. Total	11.9	82.9	5.2	0		80.1	13.3	6.1	0.6		1	96.7	0.7	1.7		7.8	16.7	73.3	2.2		
PHF	.903	.938	.557	.000	.901	.929	.750	.688	.250	.905	.375	.945	.500	.417	.965	.875	.625	.717	.500	.804	.932



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Piilani - Kilohana PM
PM Peak Hour

File Name : Piilani - Kilohana PM
Site Code : 00000000
Start Date : 6/24/2008
Page No : 1

Groups Printed- Unshifted

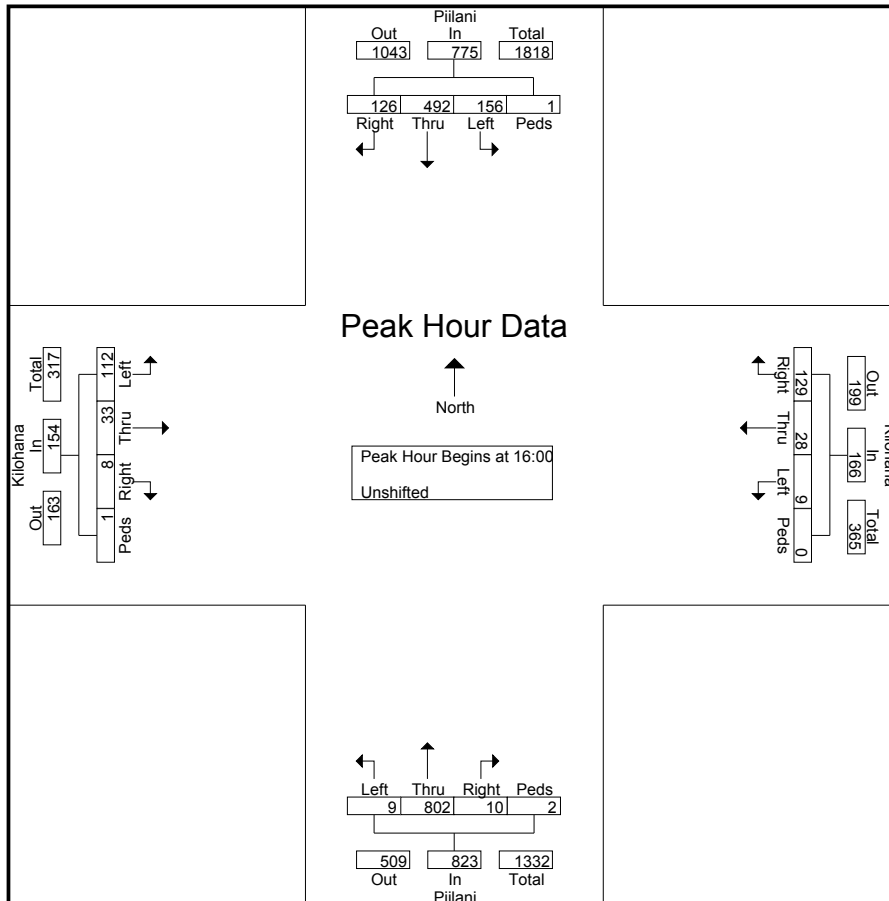
Start Time	Piilani From North				Kilohana From East				Piilani From South				Kilohana From West				Int. Total
	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	
15:15	28	152	23	0	21	3	2	0	3	154	0	0	1	6	26	0	419
15:30	26	111	21	1	22	3	1	0	4	178	5	0	3	11	30	0	416
15:45	17	140	19	0	16	3	4	0	27	107	8	0	2	9	29	0	381
Total	71	403	63	1	59	9	7	0	34	439	13	0	6	26	85	0	1216
16:00	19	145	38	0	27	6	3	0	2	229	2	0	4	9	31	0	515
16:15	36	126	43	0	31	7	1	0	1	220	5	1	1	12	28	1	513
16:30	28	117	36	1	39	8	2	0	5	190	0	0	2	5	36	0	469
16:45	43	104	39	0	32	7	3	0	2	163	2	1	1	7	17	0	421
Total	126	492	156	1	129	28	9	0	10	802	9	2	8	33	112	1	1918
17:00	24	104	44	0	36	9	2	0	1	190	3	0	0	9	17	0	439
17:15	32	101	27	0	38	8	0	0	0	158	3	0	5	10	21	0	403
Grand Total	253	1100	290	2	262	54	18	0	45	1589	28	2	19	78	235	1	3976
Apprch %	15.4	66.9	17.6	0.1	78.4	16.2	5.4	0	2.7	95.5	1.7	0.1	5.7	23.4	70.6	0.3	
Total %	6.4	27.7	7.3	0.1	6.6	1.4	0.5	0	1.1	40	0.7	0.1	0.5	2	5.9	0	

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File Name : Piilani - Kilohana PM
Site Code : 00000000
Start Date : 6/24/2008
Page No : 2

Start Time	Piilani From North					Kilohana From East					Piilani From South					Kilohana From West					Int. Total
	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	
Peak Hour Analysis From 16:00 to 16:45 - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 16:00																					
16:00	19	145	38	0	202	27	6	3	0	36	2	229	2	0	233	4	9	31	0	44	515
16:15	36	126	43	0	205	31	7	1	0	39	1	220	5	1	227	1	12	28	1	42	513
16:30	28	117	36	1	182	39	8	2	0	49	5	190	0	0	195	2	5	36	0	43	469
16:45	43	104	39	0	186	32	7	3	0	42	2	163	2	1	168	1	7	17	0	25	421
Total Volume	126	492	156	1	775	129	28	9	0	166	10	802	9	2	823	8	33	112	1	154	1918
% App. Total	16.3	63.5	20.1	0.1		77.7	16.9	5.4	0		1.2	97.4	1.1	0.2		5.2	21.4	72.7	0.6		
PHF	.733	.848	.907	.250	.945	.827	.875	.750	.000	.847	.500	.876	.450	.500	.883	.500	.688	.778	.250	.875	.931



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Piilani - Okolani AM
AM Peak Hour

File Name : Piilani - Okolani AM
Site Code : 00000000
Start Date : 6/25/2008
Page No : 1

Groups Printed- Unshifted

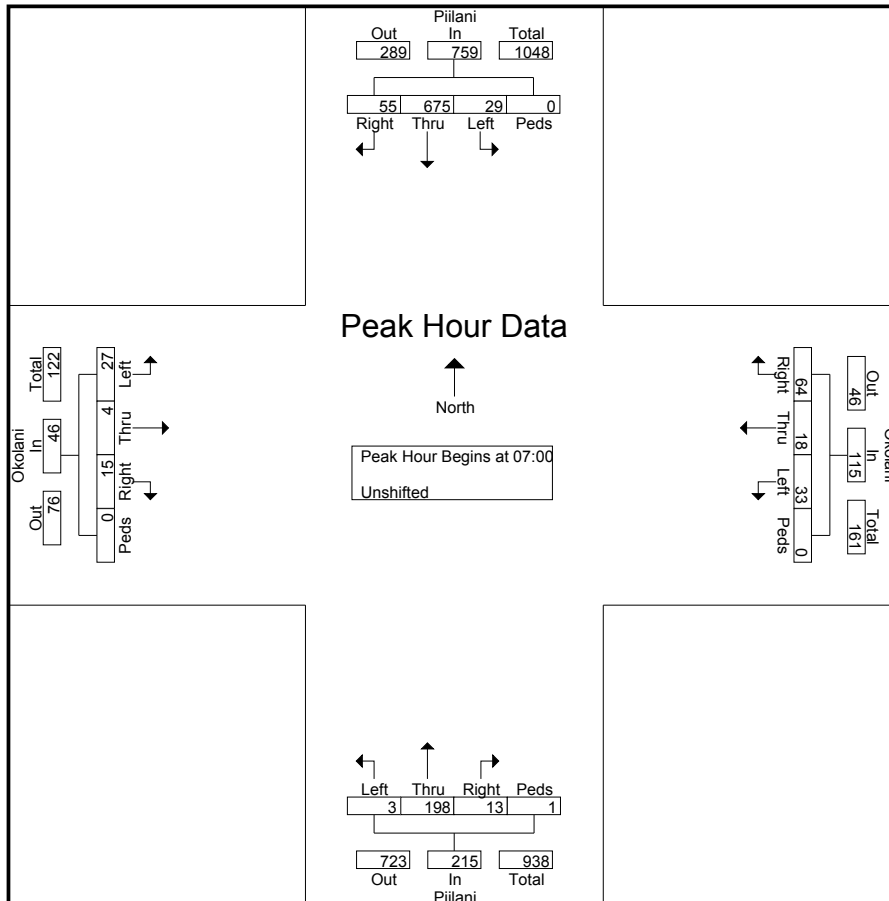
Start Time	Piilani From North				Okolani From East				Piilani From South				Okolani From West				Int. Total
	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	
06:30	10	147	5	0	23	1	1	0	2	46	0	1	1	2	11	0	250
06:45	10	162	4	0	18	1	10	0	1	33	0	0	1	2	5	0	247
Total	20	309	9	0	41	2	11	0	3	79	0	1	2	4	16	0	497
07:00	16	148	4	0	20	4	11	0	2	44	0	0	0	1	6	0	256
07:15	12	155	10	0	16	6	4	0	2	50	2	0	4	0	6	0	267
07:30	14	192	9	0	16	5	5	0	5	49	0	0	3	1	8	0	307
07:45	13	180	6	0	12	3	13	0	4	55	1	1	8	2	7	0	305
Total	55	675	29	0	64	18	33	0	13	198	3	1	15	4	27	0	1135
08:00	13	136	8	0	9	9	11	0	1	52	2	0	2	3	8	0	254
Grand Total	88	1120	46	0	114	29	55	0	17	329	5	2	19	11	51	0	1886
Apprch %	7	89.3	3.7	0	57.6	14.6	27.8	0	4.8	93.2	1.4	0.6	23.5	13.6	63	0	
Total %	4.7	59.4	2.4	0	6	1.5	2.9	0	0.9	17.4	0.3	0.1	1	0.6	2.7	0	

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File Name : Piilani - Okolani AM
Site Code : 00000000
Start Date : 6/25/2008
Page No : 2

Start Time	Piilani From North					Okolani From East					Piilani From South					Okolani From West					Int. Total
	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	
Peak Hour Analysis From 07:00 to 07:45 - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:00																					
07:00	16	148	4	0	168	20	4	11	0	35	2	44	0	0	46	0	1	6	0	7	256
07:15	12	155	10	0	177	16	6	4	0	26	2	50	2	0	54	4	0	6	0	10	267
07:30	14	192	9	0	215	16	5	5	0	26	5	49	0	0	54	3	1	8	0	12	307
07:45	13	180	6	0	199	12	3	13	0	28	4	55	1	1	61	8	2	7	0	17	305
Total Volume	55	675	29	0	759	64	18	33	0	115	13	198	3	1	215	15	4	27	0	46	1135
% App. Total	7.2	88.9	3.8	0		55.7	15.7	28.7	0		6	92.1	1.4	0.5		32.6	8.7	58.7	0		
PHF	.859	.879	.725	.000	.883	.800	.750	.635	.000	.821	.650	.900	.375	.250	.881	.469	.500	.844	.000	.676	.924



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Piilani - Okolani PM
PM Peak Hour

File Name : Piilani - Okolani PM
Site Code : 00000000
Start Date : 6/24/2008
Page No : 1

Groups Printed- Unshifted

Start Time	Piilani From North				Okolani From East				Piilani From South				Okolani From West				Int. Total
	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	
15:30	8	103	13	0	12	3	3	0	11	174	2	0	1	2	7	0	339
15:45	15	123	13	0	10	1	4	0	8	152	0	0	4	4	18	0	352
Total	23	226	26	0	22	4	7	0	19	326	2	0	5	6	25	0	691
16:00	13	104	25	0	13	1	1	0	17	206	2	1	3	5	16	0	407
16:15	6	93	25	0	12	1	6	0	3	172	3	0	6	6	15	0	348
16:30	10	97	12	1	10	8	2	0	13	167	2	0	3	6	18	0	349
16:45	10	77	14	0	8	4	4	0	5	121	0	0	2	9	12	0	266
Total	39	371	76	1	43	14	13	0	38	666	7	1	14	26	61	0	1370
17:00	13	69	16	0	15	4	4	0	12	172	1	0	1	3	9	0	319
17:15	5	70	20	0	15	3	3	0	7	130	3	0	2	3	10	0	271
Grand Total	80	736	138	1	95	25	27	0	76	1294	13	1	22	38	105	0	2651
Apprch %	8.4	77.1	14.5	0.1	64.6	17	18.4	0	5.5	93.5	0.9	0.1	13.3	23	63.6	0	
Total %	3	27.8	5.2	0	3.6	0.9	1	0	2.9	48.8	0.5	0	0.8	1.4	4	0	

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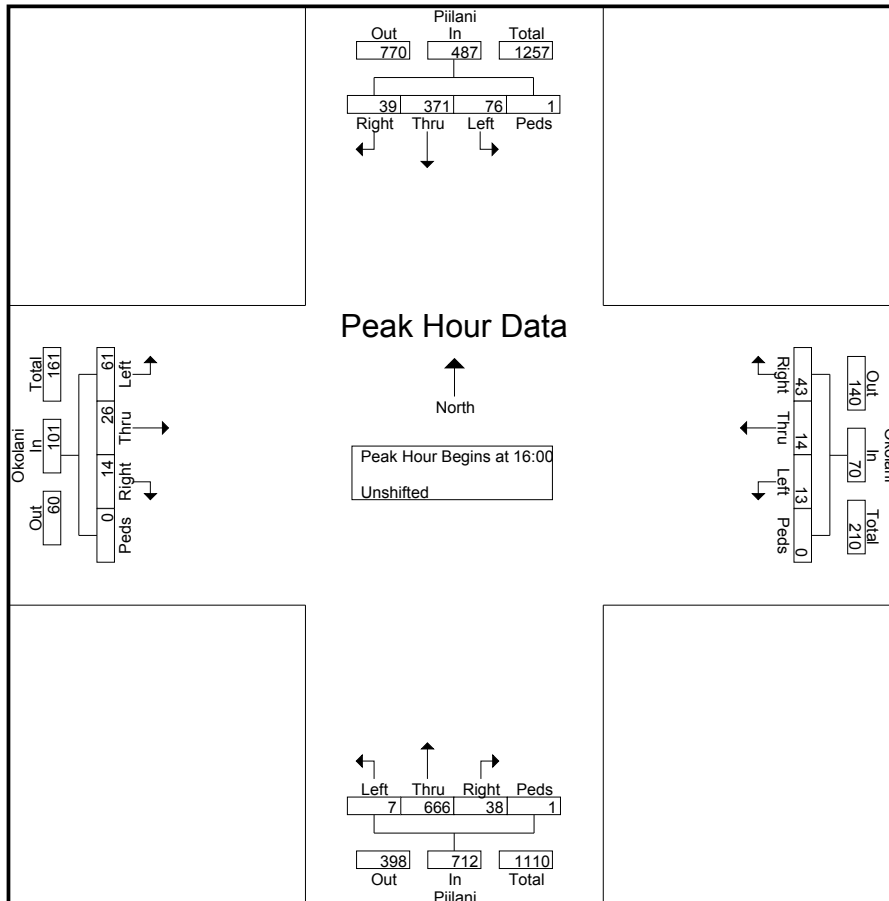
File Name : Piilani - Okolani PM

Site Code : 00000000

Start Date : 6/24/2008

Page No : 2

Start Time	Piilani From North					Okolani From East					Piilani From South					Okolani From West					Int. Total
	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	
Peak Hour Analysis From 16:00 to 16:45 - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 16:00																					
16:00	13	104	25	0	142	13	1	1	0	15	17	206	2	1	226	3	5	16	0	24	407
16:15	6	93	25	0	124	12	1	6	0	19	3	172	3	0	178	6	6	15	0	27	348
16:30	10	97	12	1	120	10	8	2	0	20	13	167	2	0	182	3	6	18	0	27	349
16:45	10	77	14	0	101	8	4	4	0	16	5	121	0	0	126	2	9	12	0	23	266
Total Volume	39	371	76	1	487	43	14	13	0	70	38	666	7	1	712	14	26	61	0	101	1370
% App. Total	8	76.2	15.6	0.2		61.4	20	18.6	0		5.3	93.5	1	0.1		13.9	25.7	60.4	0		
PHF	.750	.892	.760	.250	.857	.827	.438	.542	.000	.875	.559	.808	.583	.250	.788	.583	.722	.847	.000	.935	.842



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Wailea Ike - Kalai Waa AM
AM Peak Hour

File Name : Wailea Ike - Kalai Waa AM
Site Code : 00000000
Start Date : 6/25/2008
Page No : 1

Groups Printed- Unshifted

Start Time	Kalai Waa From North				Wailea Ike From East				Kalai Waa From South				Wailea Ike From West				Int. Total
	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	
06:30	0	0	0	0	1	117	22	0	10	0	1	0	2	38	0	0	191
06:45	0	0	0	0	0	145	27	0	4	0	2	0	1	29	0	0	208
Total	0	0	0	0	1	262	49	0	14	0	3	0	3	67	0	0	399
07:00	0	0	0	0	0	134	24	0	4	0	0	0	1	48	0	0	211
07:15	0	0	0	0	0	155	26	0	11	0	1	1	2	42	0	0	238
07:30	0	0	0	0	0	188	29	0	14	0	2	0	0	40	0	0	273
07:45	0	0	0	0	0	181	36	0	4	0	2	0	2	54	0	0	279
Total	0	0	0	0	0	658	115	0	33	0	5	1	5	184	0	0	1001
08:00	0	0	0	0	0	125	40	0	11	0	2	0	4	45	0	0	227
08:15	0	0	0	0	0	86	17	0	3	0	0	0	2	30	1	0	139
Grand Total	0	0	0	0	1	1131	221	0	61	0	10	1	14	326	1	0	1766
Apprch %	0	0	0	0	0.1	83.6	16.3	0	84.7	0	13.9	1.4	4.1	95.6	0.3	0	
Total %	0	0	0	0	0.1	64	12.5	0	3.5	0	0.6	0.1	0.8	18.5	0.1	0	

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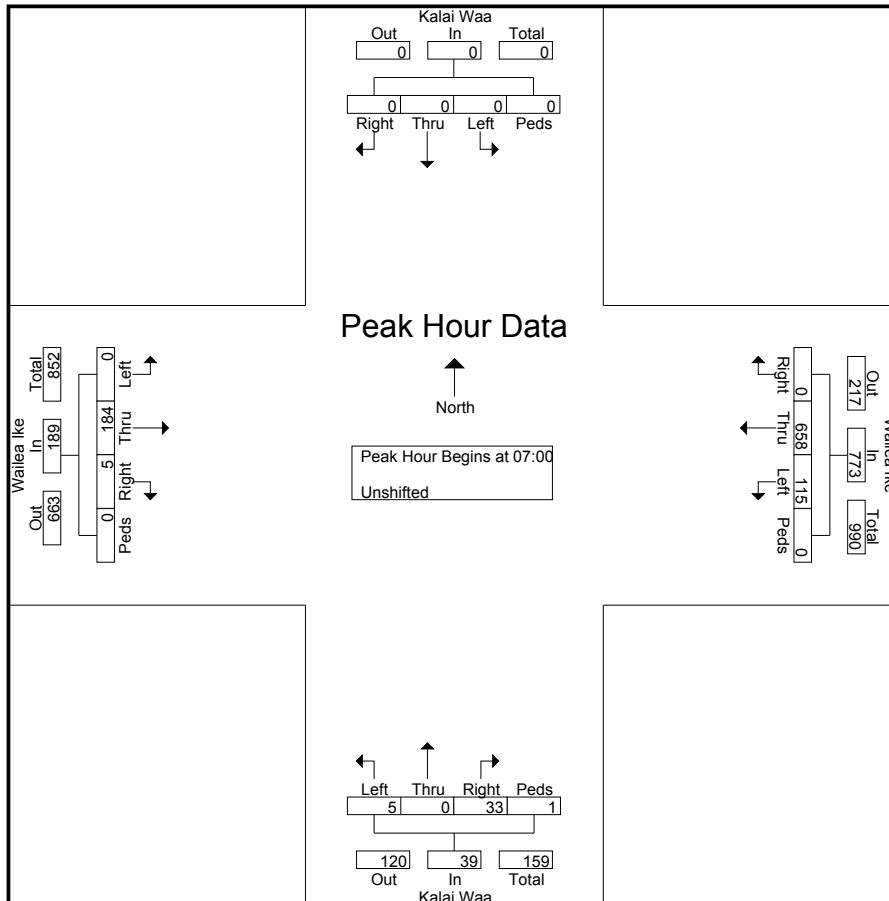
File Name : Wailea Ike - Kalai Waa AM

Site Code : 00000000

Start Date : 6/25/2008

Page No : 2

Start Time	Kalai Waa From North					Wailea Ike From East					Kalai Waa From South					Wailea Ike From West					Int. Total
	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	
Peak Hour Analysis From 07:00 to 07:45 - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:00																					
07:00	0	0	0	0	0	0	134	24	0	158	4	0	0	0	4	1	48	0	0	49	211
07:15	0	0	0	0	0	0	155	26	0	181	11	0	1	1	13	2	42	0	0	44	238
07:30	0	0	0	0	0	0	188	29	0	217	14	0	2	0	16	0	40	0	0	40	273
07:45	0	0	0	0	0	0	181	36	0	217	4	0	2	0	6	2	54	0	0	56	279
Total Volume	0	0	0	0	0	0	658	115	0	773	33	0	5	1	39	5	184	0	0	189	1001
% App. Total	0	0	0	0	0	0	85.1	14.9	0		84.6	0	12.8	2.6		2.6	97.4	0	0		
PHF	.000	.000	.000	.000	.000	.000	.875	.799	.000	.891	.589	.000	.625	.250	.609	.625	.852	.000	.000	.844	.897



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Wailea Ike - Kalai Waa PM
PM Peak Hour

File Name : Wailea Ike - Kalai Waa PM
Site Code : 00000000
Start Date : 6/24/2008
Page No : 1

Groups Printed- Unshifted

Start Time	Kalai Waa From North				Wailea Ike From East				Kalai Waa From South				Wailea Ike From West				Int. Total
	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	
15:15	0	0	0	0	0	98	10	0	36	0	1	1	2	134	0	0	282
15:30	0	0	0	0	0	109	10	0	53	0	3	0	1	139	1	0	316
15:45	0	0	0	0	2	110	25	0	34	0	1	0	3	127	0	0	302
Total	0	0	0	0	2	317	45	0	123	0	5	1	6	400	1	0	900
16:00	0	0	0	0	0	120	19	0	55	0	3	0	1	186	0	0	384
16:15	0	0	0	0	0	88	17	0	24	0	1	0	4	159	0	0	293
16:30	0	0	0	0	0	93	22	0	24	0	4	0	2	166	0	0	311
16:45	0	0	0	0	1	90	12	0	22	0	1	0	3	116	0	0	245
Total	0	0	0	0	1	391	70	0	125	0	9	0	10	627	0	0	1233
17:00	0	0	0	0	0	79	13	0	32	0	1	0	1	155	0	0	281
17:15	0	0	0	0	0	68	17	0	28	0	3	0	0	112	0	0	228
Grand Total	0	0	0	0	3	855	145	0	308	0	18	1	17	1294	1	0	2642
Apprch %	0	0	0	0	0.3	85.2	14.5	0	94.2	0	5.5	0.3	1.3	98.6	0.1	0	
Total %	0	0	0	0	0.1	32.4	5.5	0	11.7	0	0.7	0	0.6	49	0	0	

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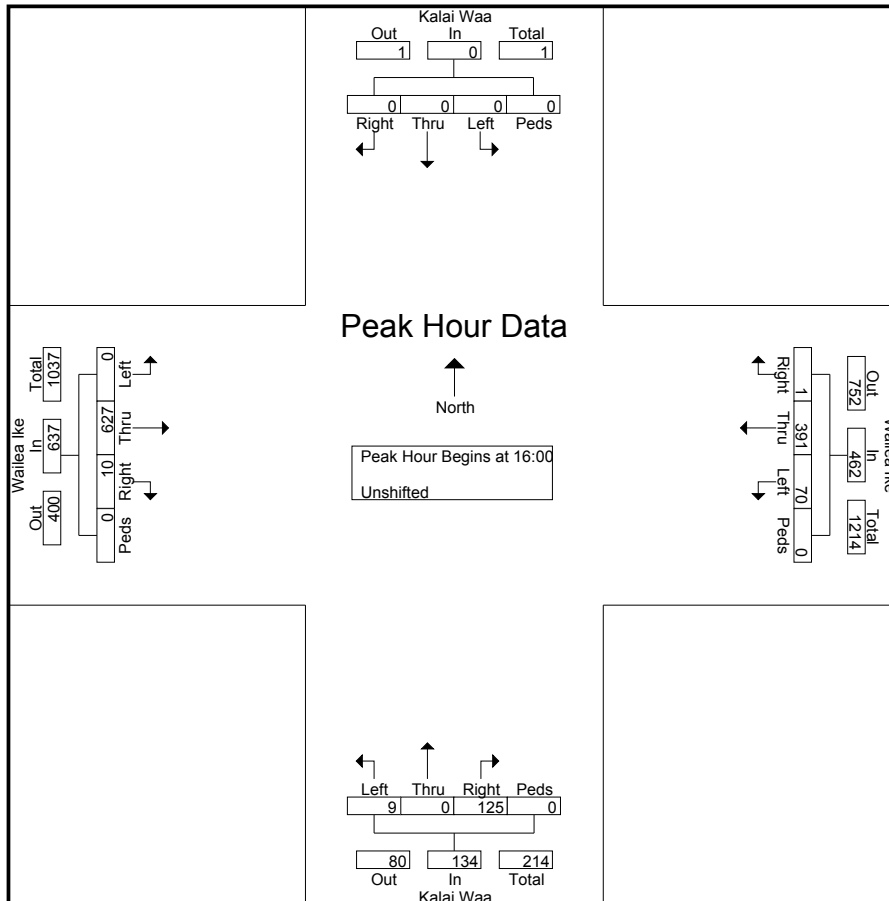
File Name : Wailea Ike - Kalai Waa PM

Site Code : 00000000

Start Date : 6/24/2008

Page No : 2

Start Time	Kalai Waa From North					Wailea Ike From East					Kalai Waa From South					Wailea Ike From West					Int. Total
	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	
Peak Hour Analysis From 16:00 to 16:45 - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 16:00																					
16:00	0	0	0	0	0	0	120	19	0	139	55	0	3	0	58	1	186	0	0	187	384
16:15	0	0	0	0	0	0	88	17	0	105	24	0	1	0	25	4	159	0	0	163	293
16:30	0	0	0	0	0	0	93	22	0	115	24	0	4	0	28	2	166	0	0	168	311
16:45	0	0	0	0	0	1	90	12	0	103	22	0	1	0	23	3	116	0	0	119	245
Total Volume	0	0	0	0	0	1	391	70	0	462	125	0	9	0	134	10	627	0	0	637	1233
% App. Total	0	0	0	0	0	0.2	84.6	15.2	0		93.3	0	6.7	0		1.6	98.4	0	0		
PHF	.000	.000	.000	.000	.000	.250	.815	.795	.000	.831	.568	.000	.563	.000	.578	.625	.843	.000	.000	.852	.803



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Wailea Alanui - Wailea Ike
 Am Peak Hour

File Name : Wailea Alanui - Wailea Ike AM
 Site Code : 00000000
 Start Date : 6/25/2008
 Page No : 1

Groups Printed- Unshifted

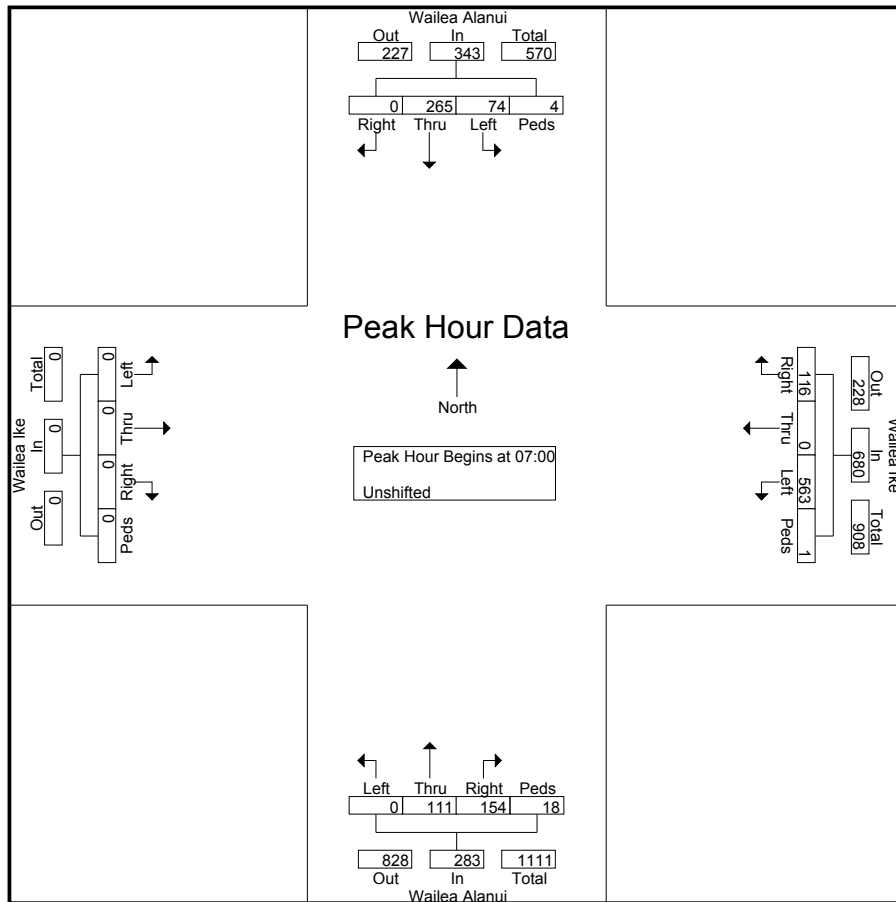
Start Time	Wailea Alanui From North				Wailea Ike From East				Wailea Alanui From South				Wailea Ike From West				Int. Total
	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	
06:30	0	49	11	1	22	0	95	1	36	18	0	4	0	0	0	0	237
06:45	0	60	10	0	16	0	147	0	25	10	0	8	0	0	0	0	276
Total	0	109	21	1	38	0	242	1	61	28	0	12	0	0	0	0	513
07:00	0	57	20	2	13	0	140	0	43	23	0	1	0	0	0	0	299
07:15	0	65	20	1	22	0	129	0	37	19	0	4	0	0	0	0	297
07:30	0	76	21	1	45	0	144	1	27	39	0	10	0	0	0	0	364
07:45	0	67	13	0	36	0	150	0	47	30	0	3	0	0	0	0	346
Total	0	265	74	4	116	0	563	1	154	111	0	18	0	0	0	0	1306
08:00	0	45	16	0	20	2	110	0	32	26	0	3	0	0	0	0	254
08:15	0	50	20	0	37	0	75	0	37	31	0	4	0	0	0	0	254
Grand Total	0	469	131	5	211	2	990	2	284	196	0	37	0	0	0	0	2327
Apprch %	0	77.5	21.7	0.8	17.5	0.2	82.2	0.2	54.9	37.9	0	7.2	0	0	0	0	
Total %	0	20.2	5.6	0.2	9.1	0.1	42.5	0.1	12.2	8.4	0	1.6	0	0	0	0	

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File Name : Wailea Alanui - Wailea Ike AM
Site Code : 0000000
Start Date : 6/25/2008
Page No : 2

Start Time	Wailea Alanui From North					Wailea Ike From East					Wailea Alanui From South					Wailea Ike From West					Int. Total
	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	
Peak Hour Analysis From 07:00 to 07:45 - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:00																					
07:00	0	57	20	2	79	13	0	140	0	153	43	23	0	1	67	0	0	0	0	0	299
07:15	0	65	20	1	86	22	0	129	0	151	37	19	0	4	60	0	0	0	0	0	297
07:30	0	76	21	1	98	45	0	144	1	190	27	39	0	10	76	0	0	0	0	0	364
07:45	0	67	13	0	80	36	0	150	0	186	47	30	0	3	80	0	0	0	0	0	346
Total Volume	0	265	74	4	343	116	0	563	1	680	154	111	0	18	283	0	0	0	0	0	1306
% App. Total	0	77.3	21.6	1.2		17.1	0	82.8	0.1		54.4	39.2	0	6.4		0	0	0	0		
PHF	.000	.872	.881	.500	.875	.644	.000	.938	.250	.895	.819	.712	.000	.450	.884	.000	.000	.000	.000	.000	.897



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Wailea Alanui - Wailea Ike PM
 PM Peak Hour

File Name : Wailea Alanui - Wailea Ike PM
 Site Code : 00000000
 Start Date : 6/24/2008
 Page No : 1

Groups Printed- Unshifted - Bank 1

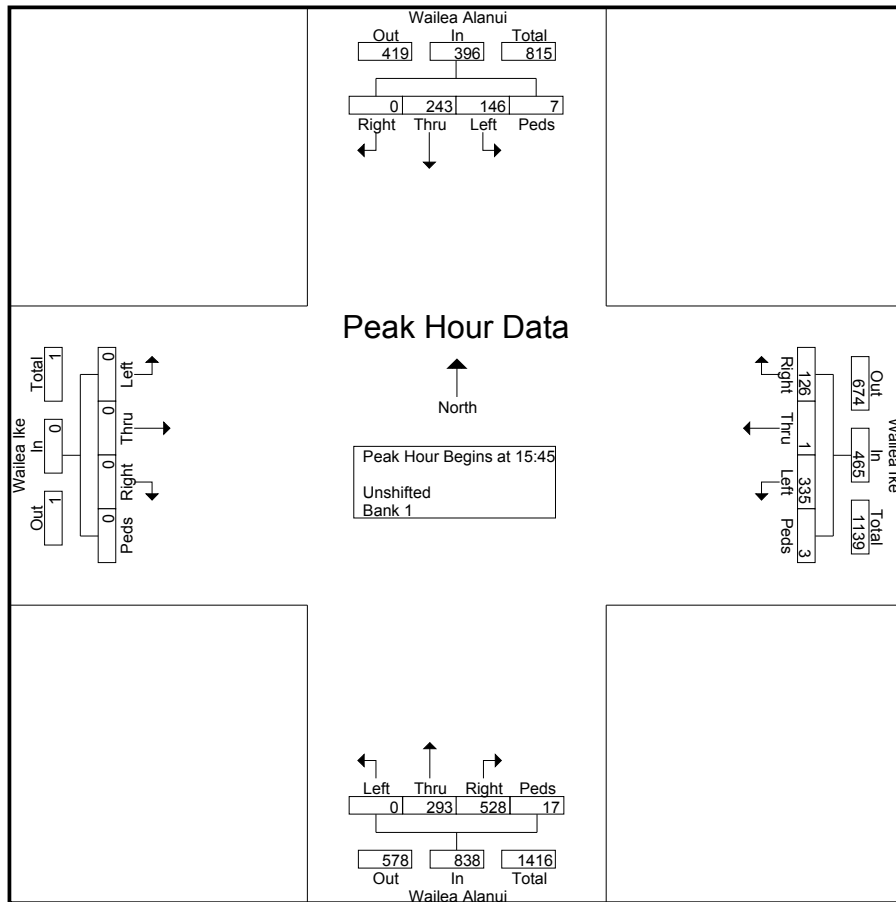
Start Time	Wailea Alanui From North				Wailea Ike From East				Wailea Alanui From South				Wailea Ike From West				Int. Total
	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	
15:15	0	53	29	1	31	0	79	1	110	72	0	5	0	0	0	0	381
15:30	0	58	29	3	37	0	75	0	121	73	1	5	0	0	0	0	402
15:45	0	60	23	0	34	0	86	0	116	56	0	1	0	0	0	0	376
Total	0	171	81	4	102	0	240	1	347	201	1	11	0	0	0	0	1159
16:00	0	56	46	2	32	0	99	0	162	89	0	1	0	0	0	0	487
16:15	0	76	35	2	31	1	73	3	128	71	0	6	0	0	0	0	426
16:30	0	51	42	3	29	0	77	0	122	77	0	9	0	0	0	0	410
16:45	0	40	23	0	21	0	82	0	82	68	0	3	0	0	0	0	319
Total	0	223	146	7	113	1	331	3	494	305	0	19	0	0	0	0	1642
17:00	0	42	37	0	24	0	54	0	122	82	0	3	0	0	0	0	364
17:15	0	37	26	0	24	0	47	0	96	69	0	1	0	0	0	0	300
Grand Total	0	473	290	11	263	1	672	4	1059	657	1	34	0	0	0	0	3465
Apprch %	0	61.1	37.5	1.4	28	0.1	71.5	0.4	60.5	37.5	0.1	1.9	0	0	0	0	
Total %	0	13.7	8.4	0.3	7.6	0	19.4	0.1	30.6	19	0	1	0	0	0	0	
Unshifted	0	473	290	11	263	1	672	4	1059	657	1	34	0	0	0	0	3465
% Unshifted	0	100	100	100	100	100	100	100	100	100	100	100	0	0	0	0	100
Bank 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Bank 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

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File Name : Wailea Alanui - Wailea Ike PM
Site Code : 00000000
Start Date : 6/24/2008
Page No : 2

Start Time	Wailea Alanui From North				Wailea Ike From East				Wailea Alanui From South				Wailea Ike From West				Int. Total				
	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total						
Peak Hour Analysis From 15:45 to 16:30 - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 15:45																					
15:45	0	60	23	0	83	34	0	86	0	120	116	56	0	1	173	0	0	0	0	0	376
16:00	0	56	46	2	104	32	0	99	0	131	162	89	0	1	252	0	0	0	0	0	487
16:15	0	76	35	2	113	31	1	73	3	108	128	71	0	6	205	0	0	0	0	0	426
16:30	0	51	42	3	96	29	0	77	0	106	122	77	0	9	208	0	0	0	0	0	410
Total Volume	0	243	146	7	396	126	1	335	3	465	528	293	0	17	838	0	0	0	0	0	1699
% App. Total	0	61.4	36.9	1.8		27.1	0.2	72	0.6		63	35	0	2		0	0	0	0	0	
PHF	.000	.799	.793	.583	.876	.926	.250	.846	.250	.887	.815	.823	.000	.472	.831	.000	.000	.000	.000	.000	.872

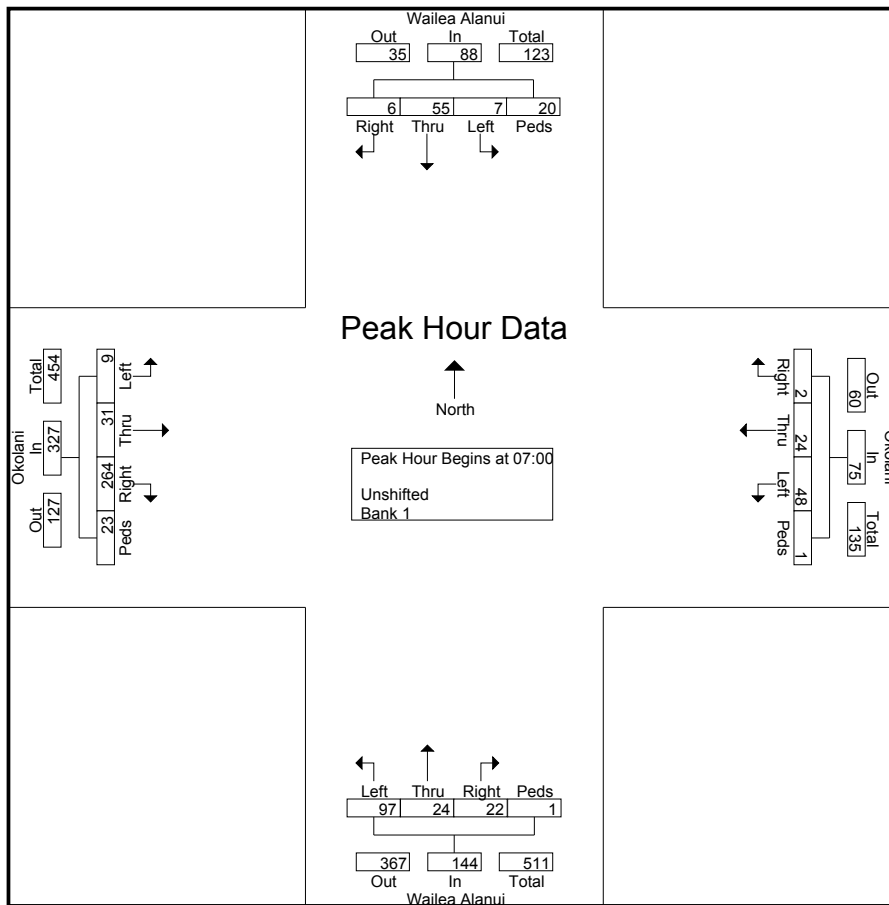


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File Name : Wailea Alanui - Okolani AM
Site Code : 00000000
Start Date : 6/25/2008
Page No : 2

Start Time	Wailea Alanui From North					Okolani From East					Wailea Alanui From South					Okolani From West					Int. Total
	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	
Peak Hour Analysis From 07:00 to 07:45 - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:00																					
07:00	1	10	1	6	18	0	3	13	1	17	2	3	21	0	26	68	10	2	4	84	145
07:15	0	10	1	3	14	2	7	16	0	25	7	7	21	0	35	61	5	2	4	72	146
07:30	2	16	2	4	24	0	7	13	0	20	11	8	22	1	42	66	10	1	13	90	176
07:45	3	19	3	7	32	0	7	6	0	13	2	6	33	0	41	69	6	4	2	81	167
Total Volume	6	55	7	20	88	2	24	48	1	75	22	24	97	1	144	264	31	9	23	327	634
% App. Total	6.8	62.5	8	22.7		2.7	32	64	1.3		15.3	16.7	67.4	0.7		80.7	9.5	2.8	7		
PHF	.500	.724	.583	.714	.688	.250	.857	.750	.250	.750	.500	.750	.735	.250	.857	.957	.775	.563	.442	.908	.901



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Wailea Alanui / Okolani
PM Peak Hour

File Name : Wailea Alanui - Okolani PM
Site Code : 00000000
Start Date : 6/24/2008
Page No : 1

Groups Printed- Unshifted - Bank 1

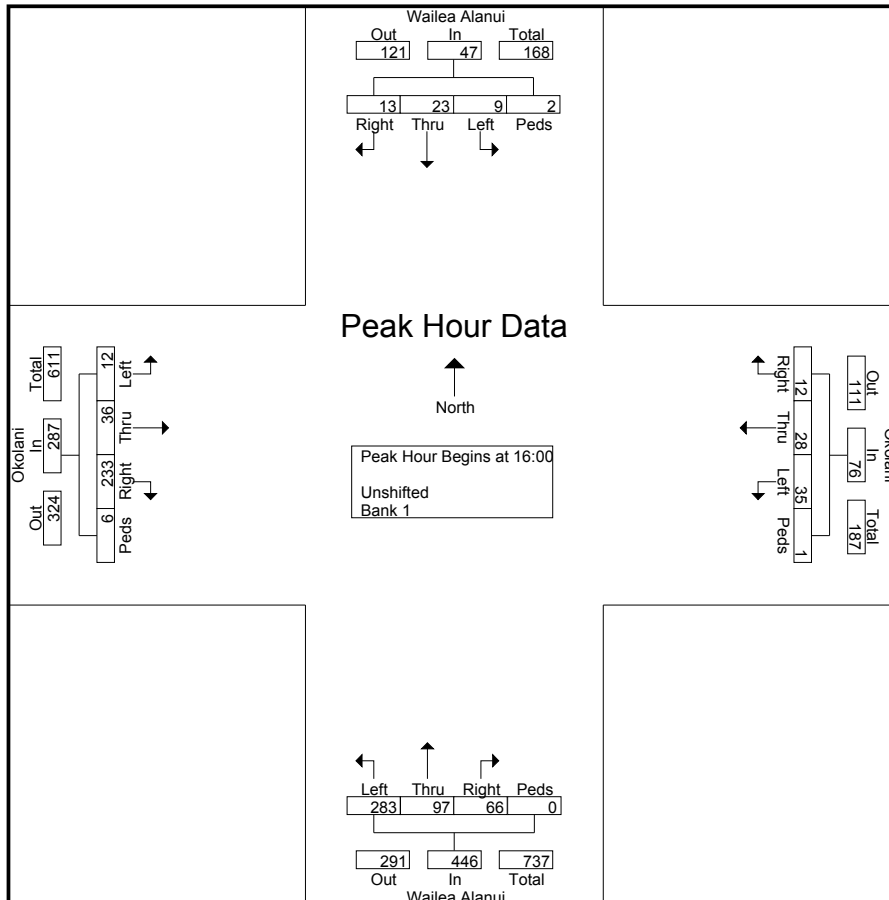
Start Time	Wailea Alanui From North				Okolani From East				Wailea Alanui From South				Okolani From West				Int. Total
	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	
15:15	0	10	0	0	1	6	9	0	16	15	68	0	47	11	3	0	186
15:30	0	9	4	0	3	8	11	0	17	28	73	0	62	6	3	3	227
15:45	4	10	1	0	1	4	11	0	16	18	71	0	47	8	3	0	194
Total	4	29	5	0	5	18	31	0	49	61	212	0	156	25	9	3	607
16:00	5	9	4	0	3	8	9	0	17	26	69	0	65	7	4	4	230
16:15	6	7	1	1	3	9	8	1	11	19	66	0	48	6	3	2	191
16:30	0	4	2	0	3	6	9	0	21	31	83	0	68	7	1	0	235
16:45	2	3	2	1	3	5	9	0	17	21	65	0	52	16	4	0	200
Total	13	23	9	2	12	28	35	1	66	97	283	0	233	36	12	6	856
17:00	0	12	0	0	2	10	9	0	13	23	73	0	51	11	4	0	208
17:15	1	4	0	0	1	6	7	0	11	13	57	0	44	11	4	2	161
Grand Total	18	68	14	2	20	62	82	1	139	194	625	0	484	83	29	11	1832
Apprch %	17.6	66.7	13.7	2	12.1	37.6	49.7	0.6	14.5	20.3	65.2	0	79.7	13.7	4.8	1.8	
Total %	1	3.7	0.8	0.1	1.1	3.4	4.5	0.1	7.6	10.6	34.1	0	26.4	4.5	1.6	0.6	
Unshifted	18	68	14	2	20	62	82	1	139	194	625	0	484	83	29	11	1832
% Unshifted	100	100	100	100	100	100	100	100	100	100	100	0	100	100	100	100	100
Bank 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Bank 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

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File Name : Wailea Alanui - Okolani PM
Site Code : 00000000
Start Date : 6/24/2008
Page No : 2

Start Time	Wailea Alanui From North					Okolani From East					Wailea Alanui From South					Okolani From West					Int. Total
	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	
Peak Hour Analysis From 16:00 to 16:45 - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 16:00																					
16:00	5	9	4	0	18	3	8	9	0	20	17	26	69	0	112	65	7	4	4	80	230
16:15	6	7	1	1	15	3	9	8	1	21	11	19	66	0	96	48	6	3	2	59	191
16:30	0	4	2	0	6	3	6	9	0	18	21	31	83	0	135	68	7	1	0	76	235
16:45	2	3	2	1	8	3	5	9	0	17	17	21	65	0	103	52	16	4	0	72	200
Total Volume	13	23	9	2	47	12	28	35	1	76	66	97	283	0	446	233	36	12	6	287	856
% App. Total	27.7	48.9	19.1	4.3		15.8	36.8	46.1	1.3		14.8	21.7	63.5	0		81.2	12.5	4.2	2.1		
PHF	.542	.639	.563	.500	.653	1.000															



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S Kihei / Kilohana
 AM Peak Hour

File Name : S Kihei - Kilohana AM
 Site Code : 00000000
 Start Date : 6/25/2008
 Page No : 1

Groups Printed- Unshifted

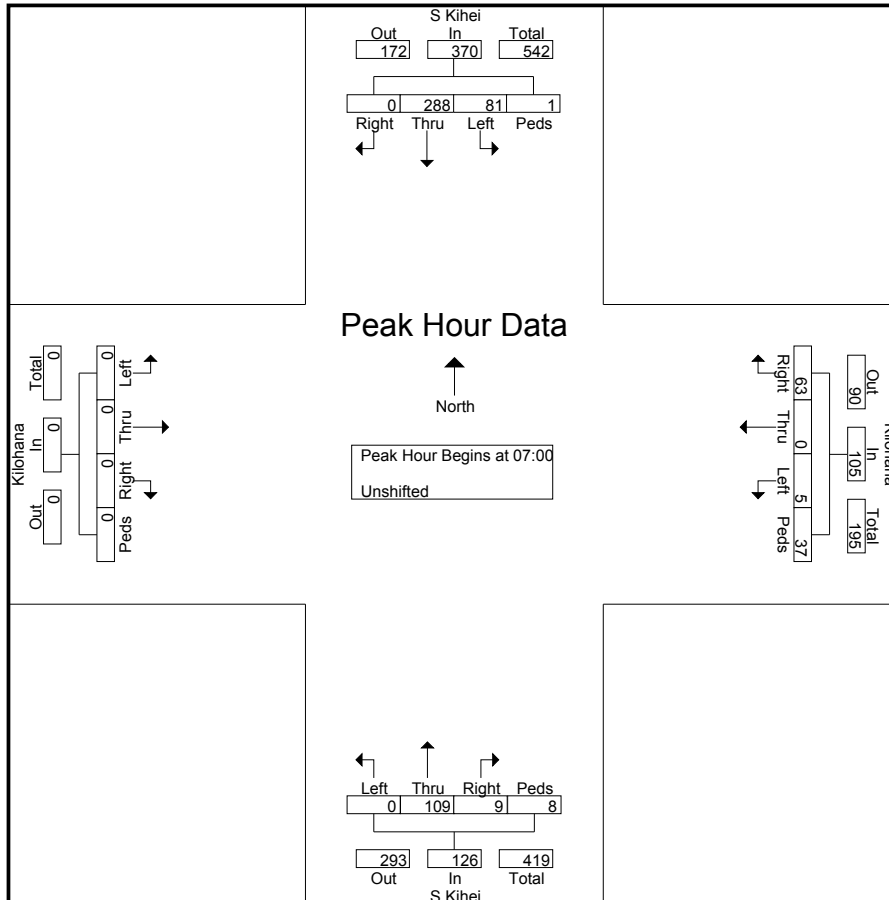
Start Time	S Kihei From North				Kilohana From East				S Kihei From South				Kilohana From West				Int. Total	
	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds		
06:30	0	61	2	0	8	0	6	16	3	19	0	0	0	0	0	0	0	115
06:45	0	56	10	0	15	0	1	8	2	19	0	2	0	0	0	0	0	113
Total	0	117	12	0	23	0	7	24	5	38	0	2	0	0	0	0	0	228
07:00	0	72	17	0	14	0	1	13	1	23	0	4	0	0	0	0	0	145
07:15	0	74	31	1	13	0	1	10	6	25	0	3	0	0	0	0	0	164
07:30	0	64	15	0	13	0	0	5	0	25	0	1	0	0	0	0	0	123
07:45	0	78	18	0	23	0	3	9	2	36	0	0	0	0	0	0	0	169
Total	0	288	81	1	63	0	5	37	9	109	0	8	0	0	0	0	0	601
08:00	0	53	13	0	19	0	6	12	2	29	0	3	0	0	0	0	0	137
Grand Total	0	458	106	1	105	0	18	73	16	176	0	13	0	0	0	0	0	966
Apprch %	0	81.1	18.8	0.2	53.6	0	9.2	37.2	7.8	85.9	0	6.3	0	0	0	0	0	
Total %	0	47.4	11	0.1	10.9	0	1.9	7.6	1.7	18.2	0	1.3	0	0	0	0	0	

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File Name : S Kihei - Kilohana AM
Site Code : 00000000
Start Date : 6/25/2008
Page No : 2

Start Time	S Kihei From North					Kilohana From East					S Kihei From South					Kilohana From West					Int. Total
	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	
Peak Hour Analysis From 07:00 to 07:45 - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:00																					
07:00	0	72	17	0	89	14	0	1	13	28	1	23	0	4	28	0	0	0	0	0	145
07:15	0	74	31	1	106	13	0	1	10	24	6	25	0	3	34	0	0	0	0	0	164
07:30	0	64	15	0	79	13	0	0	5	18	0	25	0	1	26	0	0	0	0	0	123
07:45	0	78	18	0	96	23	0	3	9	35	2	36	0	0	38	0	0	0	0	0	169
Total Volume	0	288	81	1	370	63	0	5	37	105	9	109	0	8	126	0	0	0	0	0	601
% App. Total	0	77.8	21.9	0.3		60	0	4.8	35.2		7.1	86.5	0	6.3		0	0	0	0		
PHF	.000	.923	.653	.250	.873	.685	.000	.417	.712	.750	.375	.757	.000	.500	.829	.000	.000	.000	.000	.000	.889



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S Kihei / Kilohana
PM Peak Hour

File Name : S Kihei - Kilohana PM
Site Code : 00000000
Start Date : 6/25/2008
Page No : 1

Groups Printed- Unshifted

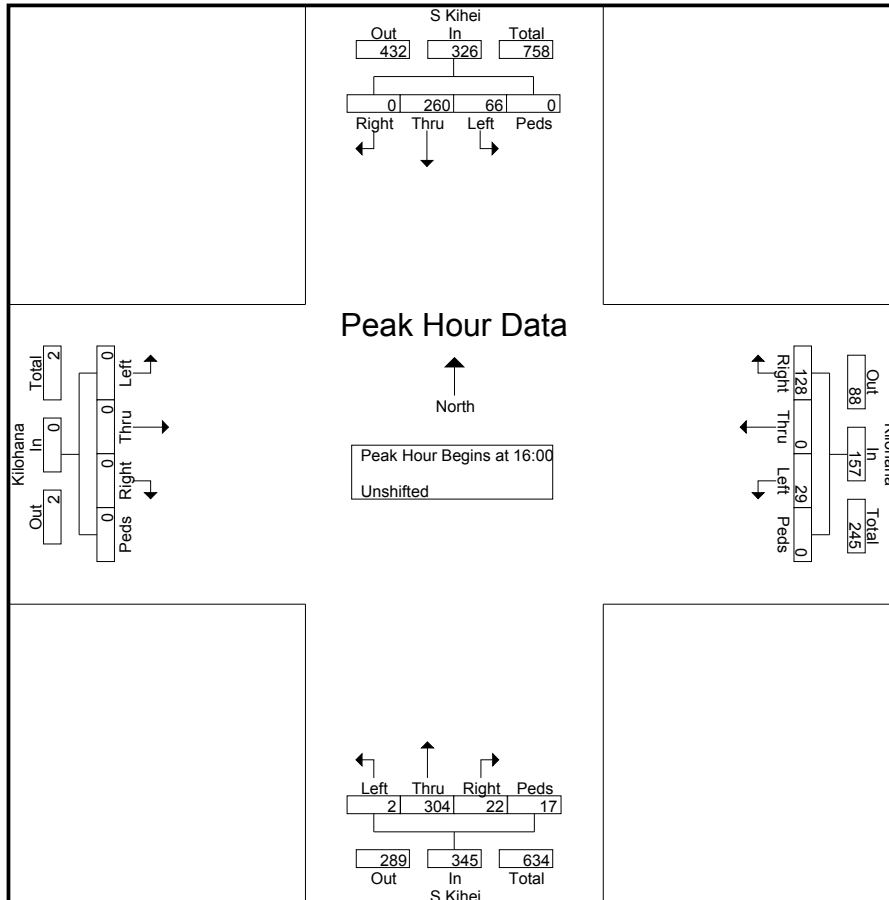
Start Time	S Kihei From North				Kilohana From East				S Kihei From South				Kilohana From West				Int. Total
	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	
15:15	0	55	14	0	22	0	2	2	4	85	0	14	0	0	0	0	198
15:30	0	69	5	0	21	0	1	0	5	76	0	13	0	0	0	0	190
15:45	0	49	14	0	30	0	5	0	3	67	0	7	0	0	0	0	175
Total	0	173	33	0	73	0	8	2	12	228	0	34	0	0	0	0	563
16:00	0	74	16	0	39	0	6	0	7	89	0	3	0	0	0	0	234
16:15	0	63	14	0	24	0	13	0	4	73	1	2	0	0	0	0	194
16:30	0	67	14	0	32	0	5	0	7	87	0	5	0	0	0	0	217
16:45	0	56	22	0	33	0	5	0	4	55	1	7	0	0	0	0	183
Total	0	260	66	0	128	0	29	0	22	304	2	17	0	0	0	0	828
17:00	0	49	14	0	20	0	7	6	4	75	0	2	0	0	0	0	177
17:15	0	46	21	0	30	0	0	0	2	71	0	4	0	0	0	0	174
Grand Total	0	528	134	0	251	0	44	8	40	678	2	57	0	0	0	0	1742
Apprch %	0	79.8	20.2	0	82.8	0	14.5	2.6	5.1	87.3	0.3	7.3	0	0	0	0	
Total %	0	30.3	7.7	0	14.4	0	2.5	0.5	2.3	38.9	0.1	3.3	0	0	0	0	

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File Name : S Kihei - Kilohana PM
Site Code : 00000000
Start Date : 6/25/2008
Page No : 2

Start Time	S Kihei From North					Kilohana From East					S Kihei From South					Kilohana From West					Int. Total
	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	
Peak Hour Analysis From 16:00 to 16:45 - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 16:00																					
16:00	0	74	16	0	90	39	0	6	0	45	7	89	0	3	99	0	0	0	0	0	234
16:15	0	63	14	0	77	24	0	13	0	37	4	73	1	2	80	0	0	0	0	0	194
16:30	0	67	14	0	81	32	0	5	0	37	7	87	0	5	99	0	0	0	0	0	217
16:45	0	56	22	0	78	33	0	5	0	38	4	55	1	7	67	0	0	0	0	0	183
Total Volume	0	260	66	0	326	128	0	29	0	157	22	304	2	17	345	0	0	0	0	0	828
% App. Total	0	79.8	20.2	0		81.5	0	18.5	0		6.4	88.1	0.6	4.9		0	0	0	0		
PHF	.000	.878	.750	.000	.906	.821	.000	.558	.000	.872	.786	.854	.500	.607	.871	.000	.000	.000	.000	.000	.885

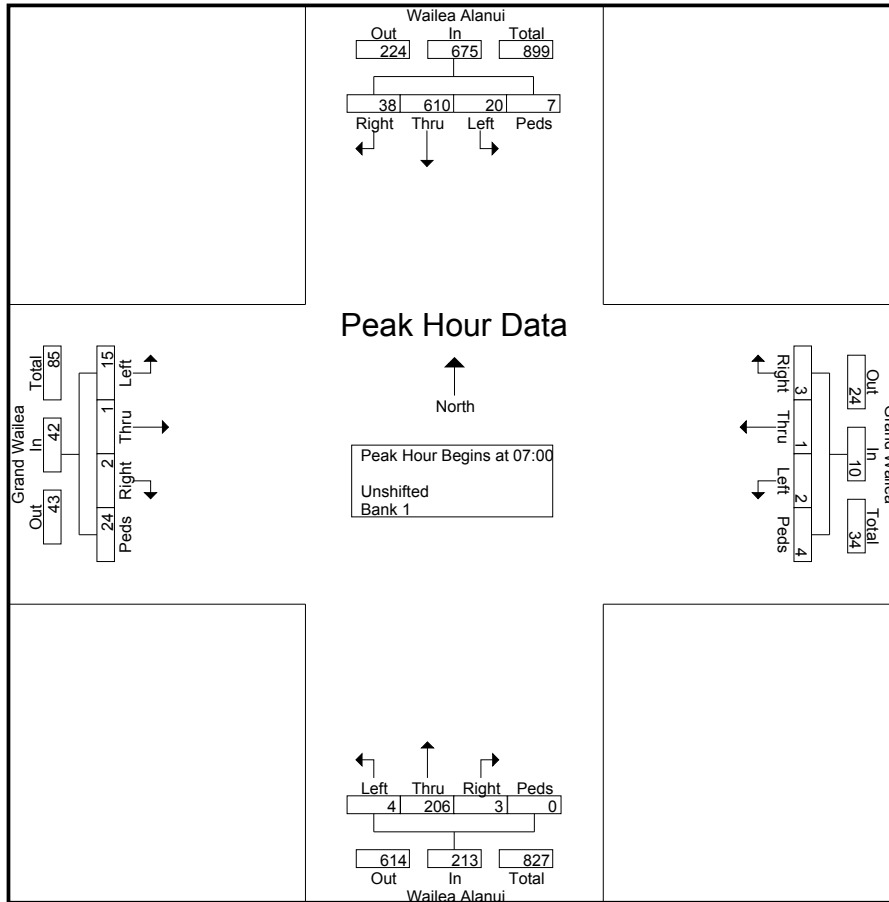


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File Name : Wailea Alanui - Grand Wailea AM
Site Code : 00000000
Start Date : 6/25/2008
Page No : 2

Start Time	Wailea Alanui From North					Grand Wailea From East					Wailea Alanui From South					Grand Wailea From West					Int. Total
	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	
Peak Hour Analysis From 07:00 to 07:45 - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:00																					
07:00	9	167	2	1	179	0	1	1	0	2	2	57	0	0	59	0	1	3	4	8	248
07:15	11	150	5	0	166	1	0	1	2	4	1	37	2	0	40	0	0	3	2	5	215
07:30	10	153	6	5	174	2	0	0	2	4	0	54	1	0	55	0	0	1	13	14	247
07:45	8	140	7	1	156	0	0	0	0	0	0	58	1	0	59	2	0	8	5	15	230
Total Volume	38	610	20	7	675	3	1	2	4	10	3	206	4	0	213	2	1	15	24	42	940
% App. Total	5.6	90.4	3	1		30	10	20	40		1.4	96.7	1.9	0		4.8	2.4	35.7	57.1		
PHF	.864	.913	.714	.350	.943	.375	.250	.500	.500	.625	.375	.888	.500	.000	.903	.250	.250	.469	.462	.700	.948

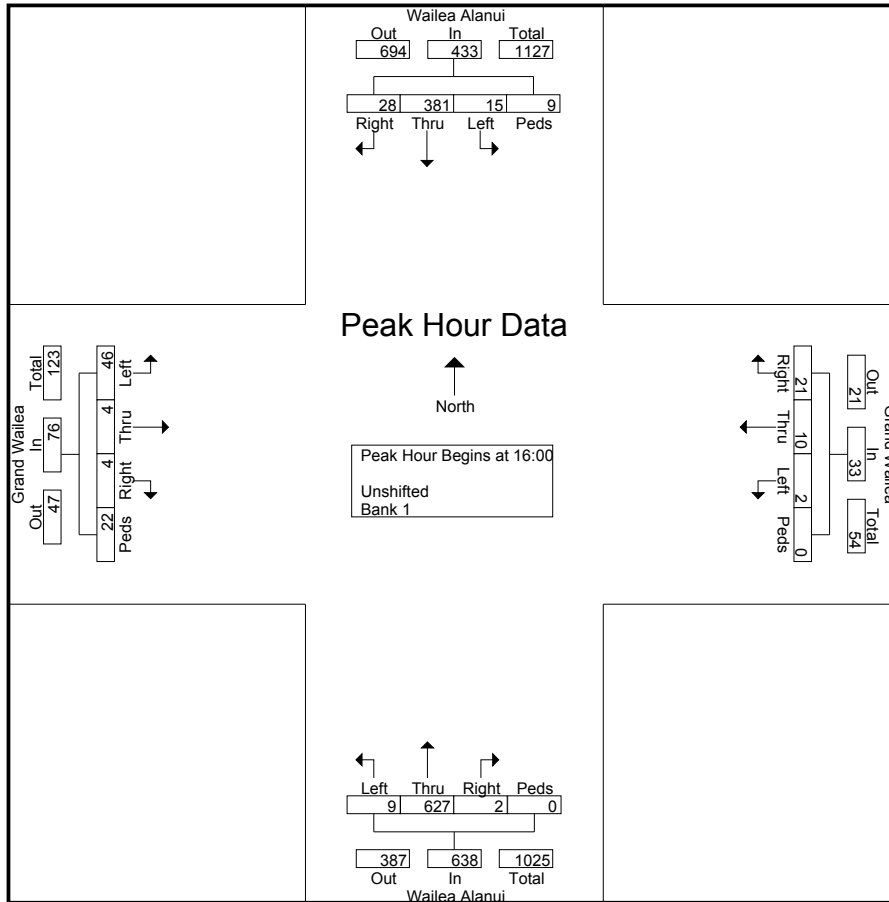


Austin, Tsutsumi and Associates

501 Sumner Street, Suite 521
Honolulu, Hawaii 96817
ph: 533-3646 Fax: 526-1267

File Name : Wailea Alanui - Grand Wailea PM
Site Code : 00000000
Start Date : 6/24/2008
Page No : 2

Start Time	Wailea Alanui From North					Grand Wailea From East					Wailea Alanui From South					Grand Wailea From West					Int. Total
	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	
Peak Hour Analysis From 16:00 to 16:45 - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 16:00																					
16:00	8	111	6	0	125	11	3	0	0	14	0	227	3	0	230	1	0	14	3	18	387
16:15	9	88	3	8	108	3	1	1	0	5	0	137	3	0	140	0	0	11	4	15	268
16:30	9	89	3	0	101	3	2	1	0	6	1	147	1	0	149	2	1	10	8	21	277
16:45	2	93	3	1	99	4	4	0	0	8	1	116	2	0	119	1	3	11	7	22	248
Total Volume	28	381	15	9	433	21	10	2	0	33	2	627	9	0	638	4	4	46	22	76	1180
% App. Total	6.5	88	3.5	2.1		63.6	30.3	6.1	0		0.3	98.3	1.4	0		5.3	5.3	60.5	28.9		
PHF	.778	.858	.625	.281	.866	.477	.625	.500	.000	.589	.500	.691	.750	.000	.693	.500	.333	.821	.688	.864	.762



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Wailea Alanui / Kauakahi
AM Peak Hour

File Name : Wailea Alanui - Kauakahi AM
Site Code : 00000000
Start Date : 6/25/2008
Page No : 1

Groups Printed- Unshifted

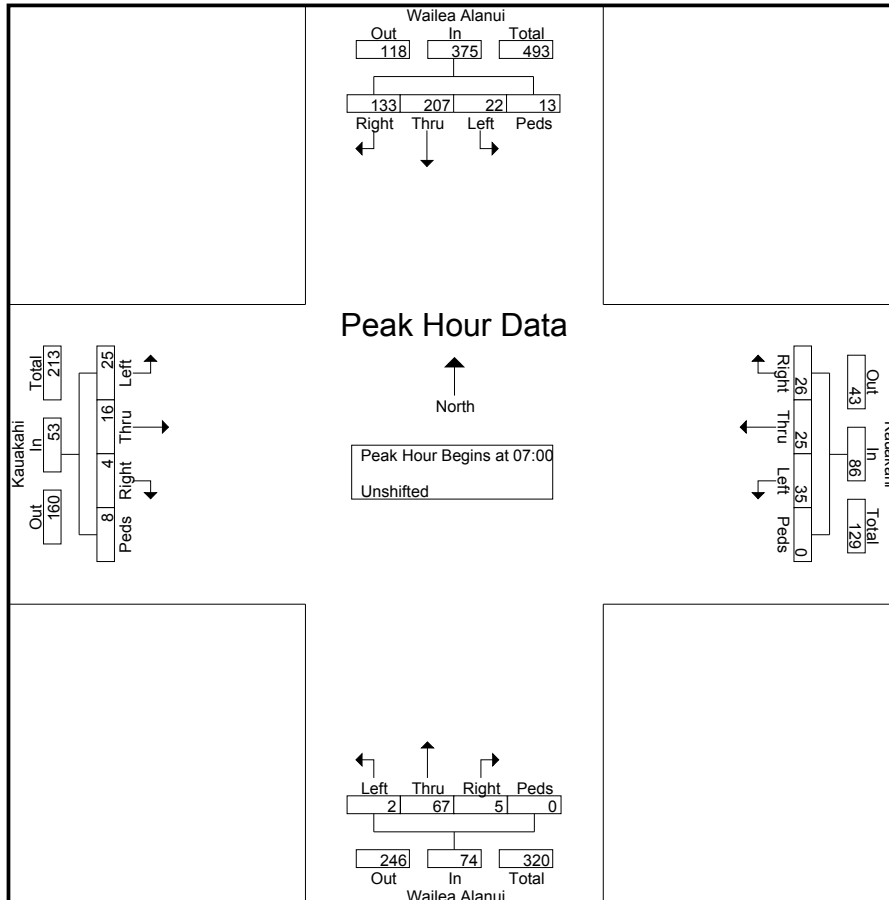
Start Time	Wailea Alanui From North				Kauakahi From East				Wailea Alanui From South				Kauakahi From West				Int. Total
	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	
06:15	12	40	9	0	5	5	3	0	1	12	1	0	1	1	3	0	93
06:30	11	43	9	0	5	3	3	0	1	14	1	0	1	3	3	0	97
06:45	20	67	4	1	7	5	3	0	2	11	0	0	1	1	6	4	132
Total	43	150	22	1	17	13	9	0	4	37	2	0	3	5	12	4	322
07:00	30	63	4	9	8	6	3	0	2	10	0	0	0	0	7	3	145
07:15	36	40	5	1	11	8	8	0	0	17	1	0	0	5	4	0	136
07:30	30	53	6	3	4	2	11	0	3	22	0	0	3	8	9	0	154
07:45	37	51	7	0	3	9	13	0	0	18	1	0	1	3	5	5	153
Total	133	207	22	13	26	25	35	0	5	67	2	0	4	16	25	8	588
08:00	17	47	3	1	4	4	8	0	1	20	0	0	2	2	4	4	117
Grand Total	193	404	47	15	47	42	52	0	10	124	4	0	9	23	41	16	1027
Apprch %	29.3	61.3	7.1	2.3	33.3	29.8	36.9	0	7.2	89.9	2.9	0	10.1	25.8	46.1	18	
Total %	18.8	39.3	4.6	1.5	4.6	4.1	5.1	0	1	12.1	0.4	0	0.9	2.2	4	1.6	

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File Name : Wailea Alanui - Kauakahi AM
Site Code : 00000000
Start Date : 6/25/2008
Page No : 2

Start Time	Wailea Alanui From North					Kauakahi From East					Wailea Alanui From South					Kauakahi From West					Int. Total
	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	
Peak Hour Analysis From 07:00 to 07:45 - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:00																					
07:00	30	63	4	9	106	8	6	3	0	17	2	10	0	0	12	0	0	7	3	10	145
07:15	36	40	5	1	82	11	8	8	0	27	0	17	1	0	18	0	5	4	0	9	136
07:30	30	53	6	3	92	4	2	11	0	17	3	22	0	0	25	3	8	9	0	20	154
07:45	37	51	7	0	95	3	9	13	0	25	0	18	1	0	19	1	3	5	5	14	153
Total Volume	133	207	22	13	375	26	25	35	0	86	5	67	2	0	74	4	16	25	8	53	588
% App. Total	35.5	55.2	5.9	3.5		30.2	29.1	40.7	0		6.8	90.5	2.7	0		7.5	30.2	47.2	15.1		
PHF	.899	.821	.786	.361	.884	.591	.694	.673	.000	.796	.417	.761	.500	.000	.740	.333	.500	.694	.400	.663	.955

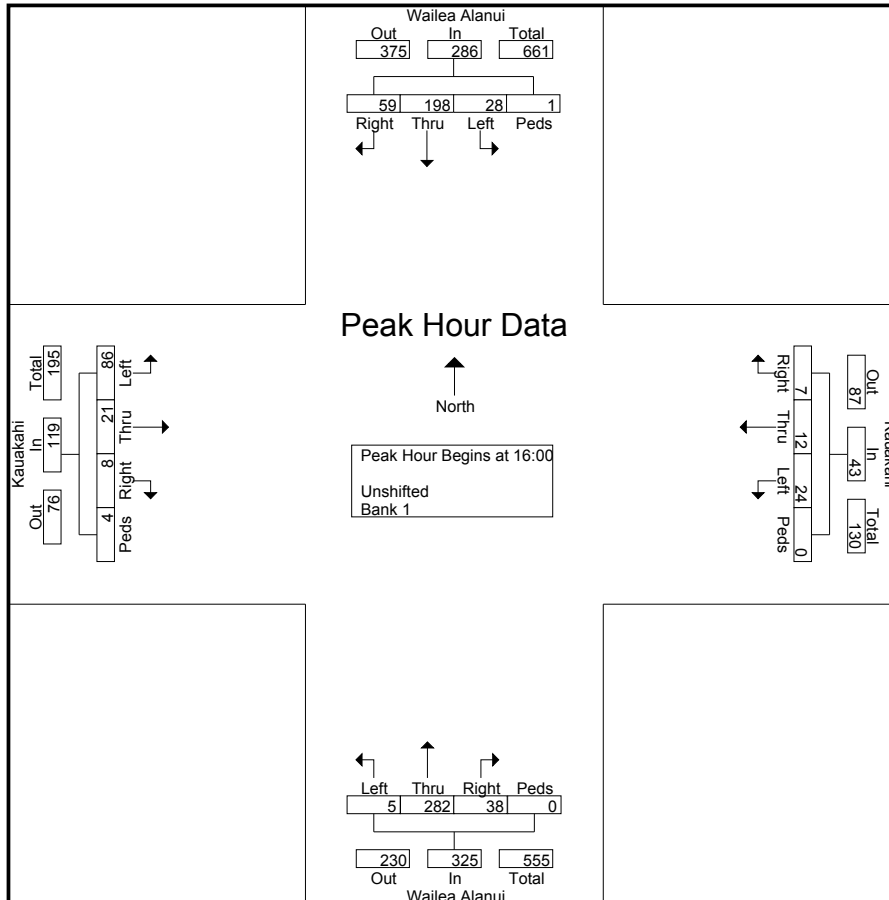


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File Name : Wailea Alanui - Kauakahi PM
Site Code : 00000000
Start Date : 6/24/2008
Page No : 2

Start Time	Wailea Alanui From North					Kauakahi From East					Wailea Alanui From South					Kauakahi From West					Int. Total
	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	
Peak Hour Analysis From 16:00 to 16:45 - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 16:00																					
16:00	13	53	10	0	76	0	2	8	0	10	17	87	1	0	105	2	6	47	2	57	248
16:15	18	46	8	0	72	3	4	4	0	11	6	57	0	0	63	2	4	12	0	18	164
16:30	18	65	5	0	88	1	3	9	0	13	8	75	2	0	85	4	7	16	1	28	214
16:45	10	34	5	1	50	3	3	3	0	9	7	63	2	0	72	0	4	11	1	16	147
Total Volume	59	198	28	1	286	7	12	24	0	43	38	282	5	0	325	8	21	86	4	119	773
% App. Total	20.6	69.2	9.8	0.3		16.3	27.9	55.8	0		11.7	86.8	1.5	0		6.7	17.6	72.3	3.4		
PHF	.819	.762	.700	.250	.813	.583	.750	.667	.000	.827	.559	.810	.625	.000	.774	.500	.750	.457	.500	.522	.779





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APPENDIX B

LEVEL OF SERVICE CRITERIA

APPENDIX B – LEVEL OF SERVICE (LOS) CRITERIA

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. As used here, total delay is defined as the total elapsed time from when a vehicle stops at the end of the queue until the vehicle departs from the stop line; this time includes the time required for the vehicle to travel from the last-in-queue position to the first-in-queue position. While the criteria for level of service for TWSC and AWSC intersections are the same, procedures to calculate the average total delay may differ.

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

LEVEL OF SERVICE CRITERIA FOR ALL-WAY STOP-CONTROLLED INTERSECTIONS (HCM 2000)

The all-way stop-controlled intersection is a special type of unsignalized intersection, where vehicles on all approaches are required to stop before entering the intersection. Generally, the sequence of entry into the intersection is on a "first come, first serve basis", according to order of arrival at the intersection. In theory, if vehicles arrive at two or more of the approaches at the same time, then according to the "rules of the road", the vehicle to the right is allowed to proceed first. However, it has been observed that two-lane AWSC intersections often operate on a virtual 2-phase patterns, where North-South streams alternate right-of-way with East-West streams. Multilane AWSC intersections generally operate in 4 phases, where each approach will take up a single phase. The table, shown below, identifies the Level of Service and corresponding average stopped delay for all-way stop-controlled intersections.

Level of Service Criteria for AWSC 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

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 \leq 20.0
C	>20.0 and \leq 35.0
D	>35.0 and \leq 55.0
E	>55.0 and \leq 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.



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APPENDIX C

LEVEL OF SERVICE CALCULATIONS



APPENDIX C

LEVEL OF SERVICE CALCULATIONS

- Existing Conditions
-

Timings
1: Kilohana Dr & Piilani HWY

Austin, Tsutsumi & Associates, Inc.
7/31/2009



Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Configurations										
Volume (vph)	66	15	11	24	145	2	291	49	780	112
Turn Type	Perm		Perm		Perm	Prot		Prot		Perm
Protected Phases		4		8		5	2	1	6	
Permitted Phases	4		8		8					6
Detector Phase	4	4	8	8	8	5	2	1	6	6
Switch Phase										
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	12.0	12.0	12.0	12.0	12.0	10.0	24.0	10.0	24.0	24.0
Total Split (s)	12.0	12.0	12.0	12.0	12.0	10.0	37.0	11.0	38.0	38.0
Total Split (%)	20.0%	20.0%	20.0%	20.0%	20.0%	16.7%	61.7%	18.3%	63.3%	63.3%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	3.0	4.0	3.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	4.0	5.0	4.0	5.0	5.0
Lead/Lag						Lead	Lag	Lead	Lag	Lag
Lead-Lag Optimize?						Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	None	Max	None	Max	Max
Act Effct Green (s)	6.7	6.7		6.7	6.7	5.7	37.3	6.5	41.6	41.6
Actuated g/C Ratio	0.12	0.12		0.12	0.12	0.10	0.66	0.11	0.73	0.73
v/c Ratio	0.45	0.11		0.20	0.49	0.01	0.26	0.26	0.62	0.10
Control Delay	34.1	20.7		26.5	10.8	24.5	7.4	27.5	9.8	1.6
Queue Delay	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	34.1	20.7		26.5	10.8	24.5	7.4	27.5	9.8	1.6
LOS	C	C		C	B	C	A	C	A	A
Approach Delay		30.7		13.9			7.5		9.8	
Approach LOS		C		B			A		A	

Intersection Summary






















Cycle Length: 60
 Actuated Cycle Length: 56.9
 Natural Cycle: 60
 Control Type: Actuated-Uncoordinated
 Maximum v/c Ratio: 0.62
 Intersection Signal Delay: 11.0
 Intersection LOS: B
 Intersection Capacity Utilization 59.7%
 ICU Level of Service B
 Analysis Period (min) 15

Splits and Phases: 1: Kilohana Dr & Piilani HWY

























HCM Signalized Intersection Capacity Analysis
1: Kilohana Dr & Piilani HWY

Austin, Tsutsumi & Associates, Inc.
7/31/2009

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	66	15	7	11	24	145	2	291	3	49	780	112
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0			5.0	5.0	4.0	5.0		4.0	5.0	5.0
Lane Util. Factor	1.00	1.00			1.00	1.00	1.00	1.00		1.00	1.00	1.00
Flt Protected	1.00	0.95			1.00	0.85	1.00	1.00		1.00	1.00	0.85
Flt Permitted	0.95	1.00			0.98	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	1770			1834	1583	1770	1860		1770	1863	1583
Satd. Flow (perm)	1364	1770			1649	1583	1770	1860		1770	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	72	16	8	12	26	158	2	316	3	53	848	122
RTOR Reduction (vph)	0	7	0	0	0	144	0	0	0	0	0	41
Lane Group Flow (vph)	72	17	0	0	38	14	2	319	0	53	848	81
Turn Type	Perm			Perm		Perm	Prot			Prot		Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8		8						6
Actuated Green, G (s)	5.5	5.5			5.5	5.5	1.1	37.6		4.0	40.5	40.5
Effective Green, g (s)	5.5	5.5			5.5	5.5	1.1	37.6		4.0	40.5	40.5
Actuated g/C Ratio	0.09	0.09			0.09	0.09	0.02	0.62		0.07	0.66	0.66
Clearance Time (s)	5.0	5.0			5.0	5.0	4.0	5.0		4.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0			3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	123	159			148	142	32	1145		116	1235	1049
v/s Ratio Prot		0.01					0.00	0.17		c0.03	c0.46	
v/s Ratio Perm	c0.05				0.02	0.01						0.05
v/c Ratio	0.59	0.11			0.26	0.10	0.06	0.28		0.46	0.69	0.08
Uniform Delay, d1	26.7	25.5			25.9	25.5	29.5	5.5		27.5	6.4	3.7
Progression Factor	1.00	1.00			1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	6.9	0.3			0.9	0.3	0.8	0.6		2.8	3.1	0.1
Delay (s)	33.6	25.8			26.8	25.8	30.3	6.1		30.3	9.5	3.8
Level of Service	C	C			C	C	C	A		C	A	A
Approach Delay (s)		31.7			26.0			6.2			9.9	
Approach LOS		C			C			A			A	
Intersection Summary												
HCM Average Control Delay			12.4									HCM Level of Service B
HCM Volume to Capacity ratio			0.68									
Actuated Cycle Length (s)			61.1								Sum of lost time (s) 14.0	
Intersection Capacity Utilization			59.7%									ICU Level of Service B
Analysis Period (min)			15									
c Critical Lane Group												

HCM Unsignalized Intersection Capacity Analysis
2: Okolani Dr. & Piilani HWY

Austin, Tsutsumi & Associates, Inc.
7/31/2009

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	27	4	15	33	18	65	3	198	13	29	675	55
Sign Control		Stop			Stop			Free			Free	
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)	29	4	16	36	20	71	3	215	14	32	734	60
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)			2			2						
Median type								None			None	
Median storage veh												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1028	1018	734	1021	1018	215	734			215		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1028	1018	734	1021	1018	215	734			215		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	83	98	96	82	92	91	100			98		
cM capacity (veh/h)	178	231	420	199	231	825	871			1355		
Direction, Lane #												
	EB 1	WB 1	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3				
Volume Total	50	126	3	215	14	32	734	60				
Volume Left	29	36	3	0	0	32	0	0				
Volume Right	16	71	0	0	14	0	0	60				
cSH	274	479	871	1700	1700	1355	1700	1700				
Volume to Capacity	0.18	0.26	0.00	0.13	0.01	0.02	0.43	0.04				
Queue Length 95th (ft)	16	26	0	0	0	2	0	0				
Control Delay (s)	23.9	17.8	9.1	0.0	0.0	7.7	0.0	0.0				
Lane LOS	C	C	A			A						
Approach Delay (s)	23.9	17.8	0.1			0.3						
Approach LOS	C	C										
Intersection Summary												
Average Delay			3.0									
Intersection Capacity Utilization			52.2%		ICU Level of Service					A		
Analysis Period (min)			15									

HCM Unsignalized Intersection Capacity Analysis
 4: Wailea Ike Dr. & Kalai Waa St

Austin, Tsutsumi & Associates, Inc.
 7/31/2009

	→	↘	↙	←	↖	↗		
Movement	EBT	EBR	WBL	WBT	NBL	NBR		
Lane Configurations	↑↑		↘	↑↑	↘	↗		
Volume (veh/h)	184	5	115	658	5	33		
Sign Control	Free			Free Stop				
Grade	0%			0%				
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92		
Hourly flow rate (vph)	200	5	125	715	5	36		
Pedestrians								
Lane Width (ft)								
Walking Speed (ft/s)								
Percent Blockage								
Right turn flare (veh)								
Median type	None			None				
Median storage (veh)								
Upstream signal (ft)				749				
pX, platoon unblocked								
vC, conflicting volume			205			810	103	
vC1, stage 1 conf vol								
vC2, stage 2 conf vol								
vCu, unblocked vol			205			810	103	
tC, single (s)			4.1			6.8	6.9	
tC, 2 stage (s)								
tF (s)			2.2			3.5	3.3	
p0 queue free %			91			98	96	
cM capacity (veh/h)			1363			288	932	
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	WB 3	NB 1	NB 2	
Volume Total	133	72	125	358	358	5	36	
Volume Left	0	0	125	0	0	5	0	
Volume Right	0	5	0	0	0	0	36	
cSH	1700	1700	1363	1700	1700	288	932	
Volume to Capacity	0.08	0.04	0.09	0.21	0.21	0.02	0.04	
Queue Length 95th (ft)	0	0	8	0	0	1	3	
Control Delay (s)	0.0	0.0	7.9	0.0	0.0	17.7	9.0	
Lane LOS			A			C	A	
Approach Delay (s)	0.0			1.2			10.2	
Approach LOS							B	
Intersection Summary								
Average Delay			1.3					
Intersection Capacity Utilization			28.2%			ICU Level of Service	A	
Analysis Period (min)			15					

Timings
7: Wailea Ike Dr. & Wailea Alanui Dr.

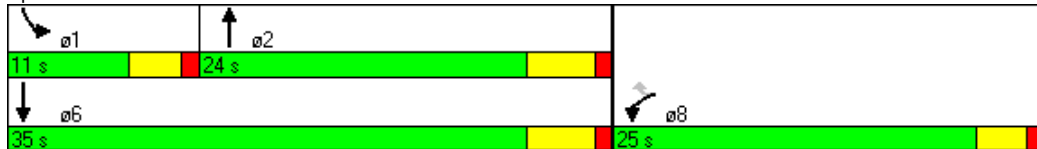
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	↙	↖	↑	↗	↘	↓
Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↙	↖	↑	↗	↘	↕
Volume (vph)	563	116	111	154	74	265
Turn Type	Perm			Free	Prot	
Protected Phases	8		2		1	6
Permitted Phases		8		Free		
Detector Phase	8	8	2		1	6
Switch Phase						
Minimum Initial (s)	4.0	4.0	4.0		4.0	4.0
Minimum Split (s)	22.0	22.0	24.0		10.0	24.0
Total Split (s)	25.0	25.0	24.0	0.0	11.0	35.0
Total Split (%)	41.7%	41.7%	40.0%	0.0%	18.3%	58.3%
Yellow Time (s)	3.0	3.0	4.0		3.0	4.0
All-Red Time (s)	1.0	1.0	1.0		1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	4.0	5.0	4.0	4.0	5.0
Lead/Lag			Lag		Lead	
Lead-Lag Optimize?			Yes		Yes	
Recall Mode	None	None	None		None	None
Act Effct Green (s)	21.1	21.1	8.8	45.0	6.6	14.6
Actuated g/C Ratio	0.47	0.47	0.20	1.00	0.15	0.32
v/c Ratio	0.74	0.16	0.33	0.11	0.31	0.25
Control Delay	20.1	3.1	20.0	0.1	23.1	10.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	20.1	3.1	20.0	0.1	23.1	10.9
LOS	C	A	C	A	C	B
Approach Delay	17.2		8.5			13.6
Approach LOS	B		A			B

Intersection Summary







Cycle Length: 60
 Actuated Cycle Length: 45
 Natural Cycle: 60
 Control Type: Actuated-Uncoordinated
 Maximum v/c Ratio: 0.74
 Intersection Signal Delay: 14.5
 Intersection LOS: B
 Intersection Capacity Utilization 49.5%
 ICU Level of Service A
 Analysis Period (min) 15

Splits and Phases: 7: Wailea Ike Dr. & Wailea Alanui Dr.

























HCM Signalized Intersection Capacity Analysis
 7: Wailea Ike Dr. & Wailea Alanui Dr.

Austin, Tsutsumi & Associates, Inc.
 7/31/2009

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↶	↷	↑	↶	↷	↑↑
Volume (vph)	563	116	111	154	74	265
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	5.0	4.0	4.0	5.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	0.95
Flt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1770	1583	1863	1583	1770	3539
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1770	1583	1863	1583	1770	3539
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	612	126	121	167	80	288
RTOR Reduction (vph)	0	69	0	0	0	0
Lane Group Flow (vph)	612	57	121	167	80	288
Turn Type		Perm		Free	Prot	
Protected Phases	8		2		1	6
Permitted Phases		8		Free		
Actuated Green, G (s)	21.2	21.2	8.8	46.7	3.7	16.5
Effective Green, g (s)	21.2	21.2	8.8	46.7	3.7	16.5
Actuated g/C Ratio	0.45	0.45	0.19	1.00	0.08	0.35
Clearance Time (s)	4.0	4.0	5.0		4.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	804	719	351	1583	140	1250
v/s Ratio Prot	c0.35		c0.06		c0.05	0.08
v/s Ratio Perm		0.04		0.11		
v/c Ratio	0.76	0.08	0.34	0.11	0.57	0.23
Uniform Delay, d1	10.6	7.2	16.4	0.0	20.7	10.6
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	4.3	0.0	0.6	0.1	5.5	0.1
Delay (s)	14.9	7.3	17.0	0.1	26.3	10.7
Level of Service	B	A	B	A	C	B
Approach Delay (s)	13.6		7.2			14.1
Approach LOS	B		A			B
Intersection Summary						
HCM Average Control Delay			12.4		HCM Level of Service	B
HCM Volume to Capacity ratio			0.63			
Actuated Cycle Length (s)			46.7		Sum of lost time (s)	13.0
Intersection Capacity Utilization			49.5%		ICU Level of Service	A
Analysis Period (min)			15			
c Critical Lane Group						











HCM Unsignalized Intersection Capacity Analysis
 8: Okolani Dr & Wailea Alanui Dr.

Austin, Tsutsumi & Associates, Inc.
 7/31/2009

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control	Stop			Stop				Stop			Stop	
Volume (vph)	9	31	264	48	24	2	97	24	22	7	55	6
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)	10	34	287	52	26	2	105	26	24	8	60	7
Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	NB 1	NB 2	NB 3	SB 1	SB 2		
Volume Total (vph)	10	34	287	78	2	105	26	24	67	7		
Volume Left (vph)	10	0	0	52	0	105	0	0	8	0		
Volume Right (vph)	0	0	287	0	2	0	0	24	0	7		
Hadj (s)	0.53	0.03	-0.67	0.37	-0.67	0.53	0.03	-0.67	0.09	-0.67		
Departure Headway (s)	5.6	5.1	3.2	5.4	4.4	5.4	4.9	3.2	5.0	4.3		
Degree Utilization, x	0.02	0.05	0.26	0.12	0.00	0.16	0.04	0.02	0.09	0.01		
Capacity (veh/h)	605	668	1112	636	776	645	706	1121	690	806		
Control Delay (s)	7.5	7.2	6.1	8.0	6.2	8.3	6.9	5.1	7.4	6.1		
Approach Delay (s)	6.2			7.9		7.5			7.3			
Approach LOS	A			A		A			A			
Intersection Summary												
Delay			6.9									
HCM Level of Service			A									
Intersection Capacity Utilization			33.6%		ICU Level of Service				A			
Analysis Period (min)			15									

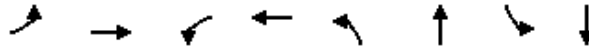
HCM Unsignalized Intersection Capacity Analysis
 9: Kilohana Dr & South Kihei Rd

Austin, Tsutsumi & Associates, Inc.
 7/31/2009

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	5	63	109	9	81	288
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	5	68	118	10	88	313
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)		1				
Median type			None			None
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	612	123			128	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	612	123			128	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	99	93			94	
cM capacity (veh/h)	429	927			1458	
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	74	128	401			
Volume Left	5	0	88			
Volume Right	68	10	0			
cSH	1001	1700	1458			
Volume to Capacity	0.07	0.08	0.06			
Queue Length 95th (ft)	6	0	5			
Control Delay (s)	9.5	0.0	2.1			
Lane LOS	A		A			
Approach Delay (s)	9.5	0.0	2.1			
Approach LOS	A					
Intersection Summary						
Average Delay		2.6				
Intersection Capacity Utilization		36.3%		ICU Level of Service		A
Analysis Period (min)		15				

Timings
10: Grand Wailea Resort & Wailea Alanui Dr.

Austin, Tsutsumi & Associates, Inc.
7/31/2009



Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations		↕		↕	↖	↗	↖	↗
Volume (vph)	15	1	2	1	4	206	20	610
Turn Type	Perm		Perm		Perm		Perm	
Protected Phases		4		8		2		6
Permitted Phases	4		8		2		6	
Detector Phase	4	4	8	8	2	2	6	6
Switch Phase								
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	20.0	20.0	20.0	24.0	24.0	24.0	24.0
Total Split (s)	20.0	20.0	20.0	20.0	25.0	25.0	25.0	25.0
Total Split (%)	44.4%	44.4%	44.4%	44.4%	55.6%	55.6%	55.6%	55.6%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode	None	None	None	None	Min	Min	Min	Min
Act Effct Green (s)		6.3		6.1	30.0	30.0	30.0	30.0
Actuated g/C Ratio		0.20		0.19	0.93	0.93	0.93	0.93
v/c Ratio		0.05		0.02	0.01	0.07	0.02	0.22
Control Delay		13.5		12.3	2.0	1.3	1.8	1.4
Queue Delay		0.0		0.0	0.0	0.0	0.0	0.0
Total Delay		13.5		12.3	2.0	1.3	1.8	1.4
LOS		B		B	A	A	A	A
Approach Delay		13.5		12.3		1.3		1.4
Approach LOS		B		B		A		A

Intersection Summary



















Cycle Length: 45
 Actuated Cycle Length: 32.3
 Natural Cycle: 45
 Control Type: Actuated-Uncoordinated
 Maximum v/c Ratio: 0.22
 Intersection Signal Delay: 1.7
 Intersection Capacity Utilization 29.7%
 Analysis Period (min) 15
 Intersection LOS: A
 ICU Level of Service A

Splits and Phases: 10: Grand Wailea Resort & Wailea Alanui Dr.























HCM Signalized Intersection Capacity Analysis
 10: Grand Wailea Resort & Wailea Alanui Dr.

Austin, Tsutsumi & Associates, Inc.
 7/31/2009

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	15	1	2	2	1	3	4	206	3	20	610	38
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0			5.0		5.0	5.0		5.0	5.0	
Lane Util. Factor		1.00			1.00		1.00	0.95		1.00	0.95	
Flt Protected		0.99			0.93		1.00	1.00		1.00	0.99	
Flt Permitted		0.96			0.98		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1762			1709		1770	3532		1770	3508	
Satd. Flow (perm)		1836			1737		715	3532		1137	3508	
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)	16	1	2	2	1	3	4	224	3	22	663	41
RTOR Reduction (vph)	0	2	0	0	3	0	0	1	0	0	5	0
Lane Group Flow (vph)	0	17	0	0	3	0	4	226	0	22	699	0
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)		1.0			1.0		25.3	25.3		25.3	25.3	
Effective Green, g (s)		1.0			1.0		25.3	25.3		25.3	25.3	
Actuated g/C Ratio		0.03			0.03		0.70	0.70		0.70	0.70	
Clearance Time (s)		5.0			5.0		5.0	5.0		5.0	5.0	
Vehicle Extension (s)		3.0			3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		51			48		498	2462		792	2445	
v/s Ratio Prot								0.06			c0.20	
v/s Ratio Perm		c0.01			0.00		0.01			0.02		
v/c Ratio		0.33			0.06		0.01	0.09		0.03	0.29	
Uniform Delay, d1		17.3			17.2		1.7	1.8		1.7	2.1	
Progression Factor		1.00			1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2		3.9			0.6		0.0	0.0		0.0	0.1	
Delay (s)		21.2			17.8		1.7	1.8		1.7	2.1	
Level of Service		C			B		A	A		A	A	
Approach Delay (s)		21.2			17.8			1.8			2.1	
Approach LOS		C			B			A			A	
Intersection Summary												
HCM Average Control Delay			2.5				HCM Level of Service			A		
HCM Volume to Capacity ratio			0.29									
Actuated Cycle Length (s)			36.3				Sum of lost time (s)		10.0			
Intersection Capacity Utilization			29.7%				ICU Level of Service		A			
Analysis Period (min)			15									
c Critical Lane Group												

HCM Unsignalized Intersection Capacity Analysis
 11: Kaukahi Dr & Wailea Alanui Dr.

Austin, Tsutsumi & Associates, Inc.
 7/31/2009

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	25	16	4	35	25	26	2	67	5	22	207	133
Sign Control		Stop			Stop			Free			Free	
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)	27	17	4	38	27	28	2	73	5	24	225	145
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type												
Median storage veh												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	364	350	225	363	495	73	370			73		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	364	350	225	363	495	73	370			73		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	95	97	99	93	94	97	100			98		
cM capacity (veh/h)	543	564	814	568	468	989	1189			1527		
Direction, Lane #												
	EB 1	WB 1	WB 2	NB 1	NB 2	SB 1	SB 2	SB 3				
Volume Total	49	65	28	75	5	24	225	145				
Volume Left	27	38	0	2	0	24	0	0				
Volume Right	4	0	28	0	5	0	0	145				
cSH	567	522	989	1189	1700	1527	1700	1700				
Volume to Capacity	0.09	0.13	0.03	0.00	0.00	0.02	0.13	0.09				
Queue Length 95th (ft)	7	11	2	0	0	1	0	0				
Control Delay (s)	11.9	12.9	8.7	0.2	0.0	7.4	0.0	0.0				
Lane LOS	B	B	A	A		A						
Approach Delay (s)	11.9	11.6		0.2		0.4						
Approach LOS	B	B										
Intersection Summary												
Average Delay			3.0									
Intersection Capacity Utilization			27.6%	ICU Level of Service	A							
Analysis Period (min)			15									

Timings
1: Kilohana Dr & Piilani HWY

Austin, Tsutsumi & Associates, Inc.
7/31/2009



Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Configurations										
Volume (vph)	112	33	9	28	129	9	802	156	555	126
Turn Type	Perm		Perm		Perm	Prot		Prot		Perm
Protected Phases		4		8		5	2	1	6	
Permitted Phases	4		8		8					6
Detector Phase	4	4	8	8	8	5	2	1	6	6
Switch Phase										
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	12.0	12.0	12.0	12.0	12.0	10.0	24.0	10.0	24.0	24.0
Total Split (s)	25.0	25.0	25.0	25.0	25.0	10.0	49.0	16.0	55.0	55.0
Total Split (%)	27.8%	27.8%	27.8%	27.8%	27.8%	11.1%	54.4%	17.8%	61.1%	61.1%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	3.0	4.0	3.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	4.0	5.0	4.0	5.0	5.0
Lead/Lag						Lead	Lag	Lead	Lag	Lag
Lead-Lag Optimize?						Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	Min	Max	Min	Max	Max
Act Effct Green (s)	12.6	12.6		12.6	12.6	5.8	44.7	11.2	50.2	50.2
Actuated g/C Ratio	0.15	0.15		0.15	0.15	0.07	0.54	0.14	0.61	0.61
v/c Ratio	0.59	0.16		0.15	0.39	0.08	0.88	0.71	0.53	0.13
Control Delay	44.1	26.2		30.9	9.0	39.4	30.0	52.4	12.4	2.0
Queue Delay	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	44.1	26.2		30.9	9.0	39.4	30.0	52.4	12.4	2.0
LOS	D	C		C	A	D	C	D	B	A
Approach Delay		39.3		13.9			30.1		18.3	
Approach LOS		D		B			C		B	

Intersection Summary























Cycle Length: 90
 Actuated Cycle Length: 82.6
 Natural Cycle: 60
 Control Type: Actuated-Uncoordinated
 Maximum v/c Ratio: 0.88
 Intersection Signal Delay: 24.5
 Intersection LOS: C
 Intersection Capacity Utilization 76.0%
 ICU Level of Service D
 Analysis Period (min) 15

Splits and Phases: 1: Kilohana Dr & Piilani HWY

























HCM Signalized Intersection Capacity Analysis
1: Kilohana Dr & Piilani HWY

Austin, Tsutsumi & Associates, Inc.
7/31/2009

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	112	33	8	9	28	129	9	802	10	156	555	126
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0			5.0	5.0	4.0	5.0		4.0	5.0	5.0
Lane Util. Factor	1.00	1.00			1.00	1.00	1.00	1.00		1.00	1.00	1.00
Flt	1.00	0.97			1.00	0.85	1.00	1.00		1.00	1.00	0.85
Flt Protected	0.95	1.00			0.99	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	1807			1840	1583	1770	1859		1770	1863	1583
Flt Permitted	0.73	1.00			0.93	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1362	1807			1735	1583	1770	1859		1770	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	122	36	9	10	30	140	10	872	11	170	603	137
RTOR Reduction (vph)	0	8	0	0	0	119	0	0	0	0	0	54
Lane Group Flow (vph)	122	37	0	0	40	21	10	883	0	170	603	83
Turn Type	Perm			Perm		Perm	Prot			Prot		Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8		8						6
Actuated Green, G (s)	12.6	12.6			12.6	12.6	5.8	44.7		11.2	50.1	50.1
Effective Green, g (s)	12.6	12.6			12.6	12.6	5.8	44.7		11.2	50.1	50.1
Actuated g/C Ratio	0.15	0.15			0.15	0.15	0.07	0.54		0.14	0.61	0.61
Clearance Time (s)	5.0	5.0			5.0	5.0	4.0	5.0		4.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0			3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	208	276			265	242	124	1007		240	1131	961
v/s Ratio Prot		0.02					0.01	c0.47		c0.10	0.32	
v/s Ratio Perm	c0.09				0.02	0.01						0.05
v/c Ratio	0.59	0.14			0.15	0.09	0.08	0.88		0.71	0.53	0.09
Uniform Delay, d1	32.5	30.2			30.3	30.0	35.9	16.5		34.1	9.4	6.7
Progression Factor	1.00	1.00			1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	4.2	0.2			0.3	0.2	0.3	10.6		9.2	1.8	0.2
Delay (s)	36.7	30.5			30.6	30.2	36.1	27.1		43.3	11.2	6.9
Level of Service	D	C			C	C	D	C		D	B	A
Approach Delay (s)		35.0			30.3			27.2			16.6	
Approach LOS		D			C			C			B	
Intersection Summary												
HCM Average Control Delay			23.6									HCM Level of Service C
HCM Volume to Capacity ratio			0.80									
Actuated Cycle Length (s)			82.5									Sum of lost time (s) 14.0
Intersection Capacity Utilization			76.0%									ICU Level of Service D
Analysis Period (min)			15									
c Critical Lane Group												

HCM Unsignalized Intersection Capacity Analysis
 2: Okolani Dr. & Piilani HWY

Austin, Tsutsumi & Associates, Inc.
 7/31/2009

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	61	26	14	13	14	43	7	666	38	76	434	39
Sign Control		Stop			Stop			Free			Free	
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)	66	28	15	14	15	47	8	724	41	83	472	42
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)			2			2						
Median type								None			None	
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1384	1376	472	1390	1376	724	472			724		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1384	1376	472	1390	1376	724	472			724		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	27	78	97	84	88	89	99			91		
cM capacity (veh/h)	91	131	592	90	131	426	1090			879		
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3				
Volume Total	110	76	8	724	41	83	472	42				
Volume Left	66	14	8	0	0	83	0	0				
Volume Right	15	47	0	0	41	0	0	42				
cSH	115	288	1090	1700	1700	879	1700	1700				
Volume to Capacity	0.95	0.26	0.01	0.43	0.02	0.09	0.28	0.02				
Queue Length 95th (ft)	152	26	1	0	0	8	0	0				
Control Delay (s)	141.7	27.7	8.3	0.0	0.0	9.5	0.0	0.0				
Lane LOS	F	D	A			A						
Approach Delay (s)	141.7	27.7	0.1			1.3						
Approach LOS	F	D										
Intersection Summary												
Average Delay			11.9									
Intersection Capacity Utilization			60.7%		ICU Level of Service					B		
Analysis Period (min)			15									

HCM Unsignalized Intersection Capacity Analysis
 4: Wailea Ike Dr. & Kalai Waa St

Austin, Tsutsumi & Associates, Inc.
 7/31/2009

	→	↘	↙	←	↖	↗	
Movement	EBT	EBR	WBL	WBT	NBL	NBR	
Lane Configurations	↑↑		↘	↑↑	↘	↘	
Volume (veh/h)	627	10	70	391	9	125	
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)	682	11	76	425	10	136	
Pedestrians							
Lane Width (ft)							
Walking Speed (ft/s)							
Percent Blockage							
Right turn flare (veh)							
Median type	None		None				
Median storage (veh)							
Upstream signal (ft)	749						
pX, platoon unblocked							
vC, conflicting volume			692		1052	346	
vC1, stage 1 conf vol							
vC2, stage 2 conf vol							
vCu, unblocked vol			692		1052	346	
tC, single (s)			4.1		6.8	6.9	
tC, 2 stage (s)							
tF (s)			2.2		3.5	3.3	
p0 queue free %			92		95	79	
cM capacity (veh/h)			899		203	650	
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	WB 3	NB 1	NB 2
Volume Total	454	238	76	212	212	10	136
Volume Left	0	0	76	0	0	10	0
Volume Right	0	11	0	0	0	0	136
cSH	1700	1700	899	1700	1700	203	650
Volume to Capacity	0.27	0.14	0.08	0.13	0.13	0.05	0.21
Queue Length 95th (ft)	0	0	7	0	0	4	20
Control Delay (s)	0.0	0.0	9.4	0.0	0.0	23.6	12.0
Lane LOS			A			C	B
Approach Delay (s)	0.0		1.4			12.8	
Approach LOS						B	
Intersection Summary							
Average Delay			1.9				
Intersection Capacity Utilization			34.9%	ICU Level of Service	A		
Analysis Period (min)			15				

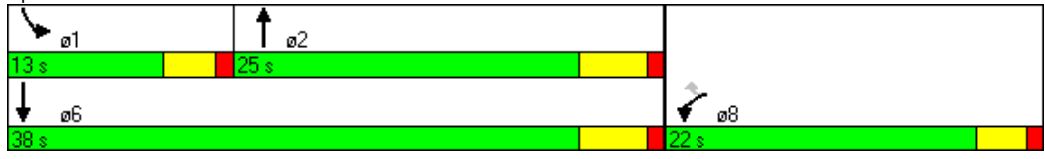
Timings
7: Wailea Ike Dr. & Wailea Alanui Dr.

Austin, Tsutsumi & Associates, Inc.
7/31/2009

	↙	↖	↑	↗	↘	↓
Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↙	↖	↑	↗	↘	↕
Volume (vph)	335	126	293	528	146	243
Turn Type	Perm			Free	Prot	
Protected Phases	8		2		1	6
Permitted Phases		8		Free		
Detector Phase	8	8	2		1	6
Switch Phase						
Minimum Initial (s)	4.0	4.0	4.0		4.0	4.0
Minimum Split (s)	22.0	22.0	24.0		10.0	24.0
Total Split (s)	22.0	22.0	25.0	0.0	13.0	38.0
Total Split (%)	36.7%	36.7%	41.7%	0.0%	21.7%	63.3%
Yellow Time (s)	3.0	3.0	4.0		3.0	4.0
All-Red Time (s)	1.0	1.0	1.0		1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	4.0	5.0	4.0	4.0	5.0
Lead/Lag			Lag		Lead	
Lead-Lag Optimize?			Yes		Yes	
Recall Mode	None	None	None		None	None
Act Effct Green (s)	14.5	14.5	13.8	47.6	8.7	23.0
Actuated g/C Ratio	0.30	0.30	0.29	1.00	0.18	0.48
v/c Ratio	0.67	0.24	0.59	0.36	0.49	0.15
Control Delay	23.9	4.8	21.1	0.6	28.1	6.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	23.9	4.8	21.1	0.6	28.1	6.8
LOS	C	A	C	A	C	A
Approach Delay	18.7		7.9		14.8	
Approach LOS	B		A		B	







Intersection Summary	
Cycle Length: 60	
Actuated Cycle Length: 47.6	
Natural Cycle: 60	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 0.67	
Intersection Signal Delay: 12.5	Intersection LOS: B
Intersection Capacity Utilization 52.9%	ICU Level of Service A
Analysis Period (min) 15	

Splits and Phases: 7: Wailea Ike Dr. & Wailea Alanui Dr.

























HCM Signalized Intersection Capacity Analysis
 7: Wailea Ike Dr. & Wailea Alanui Dr.

Austin, Tsutsumi & Associates, Inc.
 7/31/2009

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↶	↷	↑	↶	↷	↑↑
Volume (vph)	335	126	293	528	146	243
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	5.0	4.0	4.0	5.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	0.95
Flt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1770	1583	1863	1583	1770	3539
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1770	1583	1863	1583	1770	3539
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	364	137	318	574	159	264
RTOR Reduction (vph)	0	95	0	0	0	0
Lane Group Flow (vph)	364	42	318	574	159	264
Turn Type	Perm		Free		Prot	
Protected Phases	8		2		1	6
Permitted Phases	8		Free			
Actuated Green, G (s)	14.5	14.5	13.8	47.6	6.3	24.1
Effective Green, g (s)	14.5	14.5	13.8	47.6	6.3	24.1
Actuated g/C Ratio	0.30	0.30	0.29	1.00	0.13	0.51
Clearance Time (s)	4.0	4.0	5.0		4.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	539	482	540	1583	234	1792
v/s Ratio Prot	c0.21		c0.17		c0.09	0.07
v/s Ratio Perm		0.03		0.36		
v/c Ratio	0.68	0.09	0.59	0.36	0.68	0.15
Uniform Delay, d1	14.5	11.8	14.5	0.0	19.7	6.3
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	3.3	0.1	1.6	0.6	7.6	0.0
Delay (s)	17.8	11.9	16.1	0.6	27.3	6.3
Level of Service	B	B	B	A	C	A
Approach Delay (s)	16.2		6.2		14.2	
Approach LOS	B		A		B	
Intersection Summary						
HCM Average Control Delay			10.8	HCM Level of Service		B
HCM Volume to Capacity ratio			0.64			
Actuated Cycle Length (s)			47.6	Sum of lost time (s)		13.0
Intersection Capacity Utilization			52.9%	ICU Level of Service		A
Analysis Period (min)			15			
c Critical Lane Group						











HCM Unsignalized Intersection Capacity Analysis
 8: Okolani Dr & Wailea Alanui Dr.

Austin, Tsutsumi & Associates, Inc.
 7/31/2009

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control	Stop			Stop			Stop			Stop		
Volume (vph)	12	36	233	35	28	12	283	97	66	9	23	13
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)	13	39	253	38	30	13	308	105	72	10	25	14
Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	NB 1	NB 2	NB 3	SB 1	SB 2		
Volume Total (vph)	13	39	253	68	13	308	105	72	35	14		
Volume Left (vph)	13	0	0	38	0	308	0	0	10	0		
Volume Right (vph)	0	0	253	0	13	0	0	72	0	14		
Hadj (s)	0.53	0.03	-0.67	0.31	-0.67	0.53	0.03	-0.67	0.17	-0.67		
Departure Headway (s)	6.3	5.8	3.2	6.0	5.1	5.5	5.0	3.2	5.5	4.6		
Degree Utilization, x	0.02	0.06	0.23	0.11	0.02	0.47	0.15	0.06	0.05	0.02		
Capacity (veh/h)	532	580	1122	561	660	647	705	1121	632	741		
Control Delay (s)	8.2	8.0	5.9	8.6	6.9	12.0	7.6	5.2	7.6	6.5		
Approach Delay (s)	6.3			8.3			10.0			7.3		
Approach LOS	A			A			B			A		
Intersection Summary												
Delay			8.5									
HCM Level of Service			A									
Intersection Capacity Utilization			39.1%		ICU Level of Service				A			
Analysis Period (min)			15									

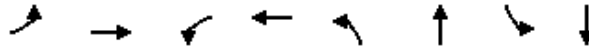
HCM Unsignalized Intersection Capacity Analysis
 9: Kilohana Dr & South Kihei Rd

Austin, Tsutsumi & Associates, Inc.
 7/31/2009

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	29	128	304	22	66	260
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	32	139	330	24	72	283
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)		1				
Median type			None			None
Median storage veh						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	768	342			354	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	768	342			354	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	91	80			94	
cM capacity (veh/h)	348	700			1204	
Direction, Lane #						
	WB 1	NB 1	SB 1			
Volume Total	171	354	354			
Volume Left	32	0	72			
Volume Right	139	24	0			
cSH	859	1700	1204			
Volume to Capacity	0.20	0.21	0.06			
Queue Length 95th (ft)	18	0	5			
Control Delay (s)	12.3	0.0	2.1			
Lane LOS	B		A			
Approach Delay (s)	12.3	0.0	2.1			
Approach LOS	B					
Intersection Summary						
Average Delay			3.2			
Intersection Capacity Utilization		48.0%		ICU Level of Service		A
Analysis Period (min)			15			

Timings
10: Grand Wailea Resort & Wailea Alanui Dr.

Austin, Tsutsumi & Associates, Inc.
7/31/2009



Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations		↕		↕	↖	↗	↖	↗
Volume (vph)	46	4	2	10	9	627	15	381
Turn Type	Perm		Perm		Perm		Perm	
Protected Phases		4		8		2		6
Permitted Phases	4		8		2		6	
Detector Phase	4	4	8	8	2	2	6	6
Switch Phase								
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	20.0	20.0	20.0	24.0	24.0	24.0	24.0
Total Split (s)	20.0	20.0	20.0	20.0	25.0	25.0	25.0	25.0
Total Split (%)	44.4%	44.4%	44.4%	44.4%	55.6%	55.6%	55.6%	55.6%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode	None	None	None	None	Min	Min	Min	Min
Act Effct Green (s)		6.9		6.6	24.7	24.7	24.7	24.7
Actuated g/C Ratio		0.22		0.21	0.80	0.80	0.80	0.80
v/c Ratio		0.14		0.10	0.01	0.24	0.03	0.16
Control Delay		10.9		7.5	4.4	3.6	4.5	3.2
Queue Delay		0.0		0.0	0.0	0.0	0.0	0.0
Total Delay		10.9		7.5	4.4	3.6	4.5	3.2
LOS		B		A	A	A	A	A
Approach Delay		10.9		7.5		3.6		3.3
Approach LOS		B		A		A		A

Intersection Summary



















Cycle Length: 45
 Actuated Cycle Length: 31
 Natural Cycle: 45
 Control Type: Actuated-Uncoordinated
 Maximum v/c Ratio: 0.24
 Intersection Signal Delay: 3.9
 Intersection LOS: A
 Intersection Capacity Utilization 35.4%
 ICU Level of Service A
 Analysis Period (min) 15

Splits and Phases: 10: Grand Wailea Resort & Wailea Alanui Dr.























HCM Signalized Intersection Capacity Analysis
 10: Grand Wailea Resort & Wailea Alanui Dr.

Austin, Tsutsumi & Associates, Inc.
 7/31/2009

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	46	4	4	2	10	21	9	627	2	15	381	28
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0			5.0		5.0	5.0		5.0	5.0	
Lane Util. Factor		1.00			1.00		1.00	0.95		1.00	0.95	
Flt Protected		0.99			0.91		1.00	1.00		1.00	0.99	
Flt Permitted		0.96			1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1769			1697		1770	3538		1770	3503	
Satd. Flow (perm)		1845			1659		922	3538		729	3503	
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)	50	4	4	2	11	23	10	682	2	16	414	30
RTOR Reduction (vph)	0	4	0	0	21	0	0	0	0	0	8	0
Lane Group Flow (vph)	0	54	0	0	15	0	10	684	0	16	436	0
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)		2.9			2.9		21.3	21.3		21.3	21.3	
Effective Green, g (s)		2.9			2.9		21.3	21.3		21.3	21.3	
Actuated g/C Ratio		0.08			0.08		0.62	0.62		0.62	0.62	
Clearance Time (s)		5.0			5.0		5.0	5.0		5.0	5.0	
Vehicle Extension (s)		3.0			3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		156			141		574	2203		454	2182	
v/s Ratio Prot								c0.19			0.12	
v/s Ratio Perm		c0.03			0.01		0.01			0.02		
v/c Ratio		0.35			0.11		0.02	0.31		0.04	0.20	
Uniform Delay, d1		14.8			14.5		2.5	3.0		2.5	2.8	
Progression Factor		1.00			1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2		1.4			0.3		0.0	0.1		0.0	0.0	
Delay (s)		16.1			14.8		2.5	3.1		2.5	2.8	
Level of Service		B			B		A	A		A	A	
Approach Delay (s)		16.1			14.8			3.1			2.8	
Approach LOS		B			B			A			A	
Intersection Summary												
HCM Average Control Delay			3.9				HCM Level of Service			A		
HCM Volume to Capacity ratio			0.31									
Actuated Cycle Length (s)			34.2				Sum of lost time (s)		10.0			
Intersection Capacity Utilization			35.4%				ICU Level of Service		A			
Analysis Period (min)			15									
c Critical Lane Group												

HCM Unsignalized Intersection Capacity Analysis
 11: Kaukahi Dr & Wailea Alanui Dr.

Austin, Tsutsumi & Associates, Inc.
 7/31/2009

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	86	21	8	24	12	7	5	282	38	28	198	59
Sign Control		Stop			Stop			Free			Free	
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)	93	23	9	26	13	8	5	307	41	30	215	64
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	600	593	215	614	658	307	279			307		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	600	593	215	614	658	307	279			307		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	76	94	99	93	97	99	100			98		
cM capacity (veh/h)	389	406	825	375	373	733	1283			1254		
Direction, Lane #	EB 1	WB 1	WB 2	NB 1	NB 2	SB 1	SB 2	SB 3				
Volume Total	125	39	8	312	41	30	215	64				
Volume Left	93	26	0	5	0	30	0	0				
Volume Right	9	0	8	0	41	0	0	64				
cSH	407	374	733	1283	1700	1254	1700	1700				
Volume to Capacity	0.31	0.10	0.01	0.00	0.02	0.02	0.13	0.04				
Queue Length 95th (ft)	32	9	1	0	0	2	0	0				
Control Delay (s)	17.7	15.7	10.0	0.2	0.0	7.9	0.0	0.0				
Lane LOS	C	C	A	A		A						
Approach Delay (s)	17.7	14.8		0.2		0.8						
Approach LOS	C	B										
Intersection Summary												
Average Delay			3.8									
Intersection Capacity Utilization			43.0%		ICU Level of Service					A		
Analysis Period (min)			15									



APPENDIX C

LEVEL OF SERVICE CALCULATIONS

- Base Year 2016 WITHOUT Project
-

Timings
1: Kilohana Dr & Piilani HWY

Austin, Tsutsumi & Associates, Inc.
7/31/2009



Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Configurations										
Volume (vph)	155	20	15	25	155	5	685	50	1240	150
Turn Type	Perm		Perm		Perm	Prot		Prot		Perm
Protected Phases		4		8		5	2	1	6	
Permitted Phases	4		8		8					6
Detector Phase	4	4	8	8	8	5	2	1	6	6
Switch Phase										
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	12.0	12.0	12.0	12.0	12.0	10.0	24.0	10.0	24.0	24.0
Total Split (s)	12.0	12.0	12.0	12.0	12.0	10.0	37.0	11.0	38.0	38.0
Total Split (%)	20.0%	20.0%	20.0%	20.0%	20.0%	16.7%	61.7%	18.3%	63.3%	63.3%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	3.0	4.0	3.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	4.0	5.0	4.0	5.0	5.0
Lead/Lag						Lead	Lag	Lead	Lag	Lag
Lead-Lag Optimize?						Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	None	Max	None	Max	Max
Act Effct Green (s)	7.1	7.1		7.1	7.1	5.7	35.4	6.6	39.9	39.9
Actuated g/C Ratio	0.12	0.12		0.12	0.12	0.10	0.60	0.11	0.68	0.68
v/c Ratio	1.04	0.15		0.22	0.50	0.03	0.67	0.27	1.07	0.15
Control Delay	113.7	20.4		27.0	10.7	25.0	13.5	27.8	60.4	1.5
Queue Delay	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	113.7	20.4		27.0	10.7	25.0	13.5	27.8	60.4	1.5
LOS	F	C		C	B	C	B	C	E	A
Approach Delay		98.4		14.0			13.6		53.2	
Approach LOS		F		B			B		D	

Intersection Summary






















Cycle Length: 60
 Actuated Cycle Length: 59
 Natural Cycle: 110
 Control Type: Actuated-Uncoordinated
 Maximum v/c Ratio: 1.07
 Intersection Signal Delay: 42.5
 Intersection LOS: D
 Intersection Capacity Utilization 88.9%
 ICU Level of Service E
 Analysis Period (min) 15

Splits and Phases: 1: Kilohana Dr & Piilani HWY



HCM Signalized Intersection Capacity Analysis
1: Kilohana Dr & Piilani HWY

Austin, Tsutsumi & Associates, Inc.
7/31/2009

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	155	20	10	15	25	155	5	685	5	50	1240	150
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0			5.0	5.0	4.0	5.0		4.0	5.0	5.0
Lane Util. Factor	1.00	1.00			1.00	1.00	1.00	1.00		1.00	1.00	1.00
Flt	1.00	0.95			1.00	0.85	1.00	1.00		1.00	1.00	0.85
Flt Protected	0.95	1.00			0.98	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	1770			1829	1583	1770	1861		1770	1863	1583
Flt Permitted	0.73	1.00			0.86	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1358	1770			1609	1583	1770	1861		1770	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	168	22	11	16	27	168	5	745	5	54	1348	163
RTOR Reduction (vph)	0	10	0	0	0	149	0	0	0	0	0	58
Lane Group Flow (vph)	168	23	0	0	43	19	5	750	0	54	1348	105
Turn Type	Perm			Perm		Perm	Prot			Prot		Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8		8						6
Actuated Green, G (s)	7.1	7.1			7.1	7.1	1.2	37.0		4.1	39.9	39.9
Effective Green, g (s)	7.1	7.1			7.1	7.1	1.2	37.0		4.1	39.9	39.9
Actuated g/C Ratio	0.11	0.11			0.11	0.11	0.02	0.59		0.07	0.64	0.64
Clearance Time (s)	5.0	5.0			5.0	5.0	4.0	5.0		4.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0			3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	155	202			184	181	34	1107		117	1195	1015
v/s Ratio Prot		0.01					0.00	0.40		c0.03	c0.72	
v/s Ratio Perm	c0.12				0.03	0.01						0.07
v/c Ratio	1.08	0.12			0.23	0.11	0.15	0.68		0.46	1.13	0.10
Uniform Delay, d1	27.6	24.7			25.1	24.7	30.0	8.5		28.0	11.2	4.3
Progression Factor	1.00	1.00			1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	96.5	0.3			0.7	0.3	2.0	3.3		2.9	68.7	0.2
Delay (s)	124.0	25.0			25.7	25.0	32.0	11.9		30.9	79.9	4.5
Level of Service	F	C			C	C	C	B		C	E	A
Approach Delay (s)		107.8			25.1			12.0			70.3	
Approach LOS		F			C			B			E	
Intersection Summary												
HCM Average Control Delay			53.5									HCM Level of Service D
HCM Volume to Capacity ratio			1.12									
Actuated Cycle Length (s)			62.2									Sum of lost time (s) 14.0
Intersection Capacity Utilization			88.9%									ICU Level of Service E
Analysis Period (min)			15									
c Critical Lane Group												

Timings
2: Okolani Dr. & Piilani HWY

Austin, Tsutsumi & Associates, Inc.
7/31/2009

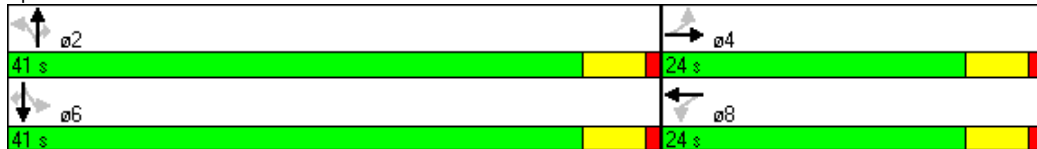


Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations										
Volume (vph)	185	15	35	20	10	440	15	35	1055	135
Turn Type	Perm		Perm		Perm		Perm	Perm		Perm
Protected Phases		4		8		2			6	
Permitted Phases	4		8		2		2	6		6
Detector Phase	4	4	8	8	2	2	2	6	6	6
Switch Phase										
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0
Total Split (s)	24.0	24.0	24.0	24.0	41.0	41.0	41.0	41.0	41.0	41.0
Total Split (%)	36.9%	36.9%	36.9%	36.9%	63.1%	63.1%	63.1%	63.1%	63.1%	63.1%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag										
Lead-Lag Optimize?										
Recall Mode	None	None	None	None	Min	Min	Min	Min	Min	Min
Act Effct Green (s)	14.2	14.2		14.2	38.9	38.9	38.9	38.9	38.9	38.9
Actuated g/C Ratio	0.23	0.23		0.23	0.62	0.62	0.62	0.62	0.62	0.62
v/c Ratio	0.68	0.11		0.33	0.09	0.42	0.02	0.07	1.00	0.14
Control Delay	33.6	10.6		11.5	8.9	8.5	3.4	6.7	43.3	1.8
Queue Delay	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	33.6	10.6		11.5	8.9	8.5	3.4	6.7	43.3	1.8
LOS	C	B		B	A	A	A	A	D	A
Approach Delay		29.6		11.5		8.3			37.7	
Approach LOS		C		B		A			D	

Intersection Summary

Cycle Length: 65
 Actuated Cycle Length: 63.1
 Natural Cycle: 80
 Control Type: Actuated-Uncoordinated
 Maximum v/c Ratio: 1.00
 Intersection Signal Delay: 28.5
 Intersection LOS: C
 Intersection Capacity Utilization 80.8%
 ICU Level of Service D
 Analysis Period (min) 15

Splits and Phases: 2: Okolani Dr. & Piilani HWY



HCM Signalized Intersection Capacity Analysis
2: Okolani Dr. & Piilani HWY

Austin, Tsutsumi & Associates, Inc.
7/31/2009

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	185	15	25	35	20	70	10	440	15	35	1055	135
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0			5.0		5.0	5.0	5.0	5.0	5.0	5.0
Lane Util. Factor	1.00	1.00			1.00		1.00	1.00	1.00	1.00	1.00	1.00
Flt Protected	1.00	0.91			0.92		1.00	1.00	0.85	1.00	1.00	0.85
Flt Permitted	0.95	1.00			0.99		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	1687			1698		1770	1863	1583	1770	1863	1583
Satd. Flow (perm)	1314	1687			1564		192	1863	1583	825	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)	201	16	27	38	22	76	11	478	16	38	1147	147
RTOR Reduction (vph)	0	21	0	0	59	0	0	0	6	0	0	56
Lane Group Flow (vph)	201	22	0	0	77	0	11	478	10	38	1147	91
Turn Type	Perm			Perm			Perm		Perm	Perm		Perm
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2		2	6		6
Actuated Green, G (s)	14.2	14.2			14.2		38.9	38.9	38.9	38.9	38.9	38.9
Effective Green, g (s)	14.2	14.2			14.2		38.9	38.9	38.9	38.9	38.9	38.9
Actuated g/C Ratio	0.23	0.23			0.23		0.62	0.62	0.62	0.62	0.62	0.62
Clearance Time (s)	5.0	5.0			5.0		5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0			3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	296	380			352		118	1149	976	509	1149	976
v/s Ratio Prot		0.01						0.26			c0.62	
v/s Ratio Perm	c0.15				0.05		0.06		0.01	0.05		0.06
v/c Ratio	0.68	0.06			0.22		0.09	0.42	0.01	0.07	1.00	0.09
Uniform Delay, d1	22.4	19.2			19.9		4.9	6.2	4.7	4.9	12.1	4.9
Progression Factor	1.00	1.00			1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	6.1	0.1			0.3		0.3	0.2	0.0	0.1	25.9	0.0
Delay (s)	28.4	19.3			20.2		5.3	6.5	4.7	4.9	38.0	5.0
Level of Service	C	B			C		A	A	A	A	D	A
Approach Delay (s)		26.8			20.2			6.4			33.4	
Approach LOS		C			C			A			C	
Intersection Summary												
HCM Average Control Delay			25.7				HCM Level of Service			C		
HCM Volume to Capacity ratio			0.91									
Actuated Cycle Length (s)			63.1				Sum of lost time (s)		10.0			
Intersection Capacity Utilization			80.8%				ICU Level of Service		D			
Analysis Period (min)			15									
c Critical Lane Group												

HCM Unsignalized Intersection Capacity Analysis
4: Wailea Ike Dr. & Kalai Waa St

Austin, Tsutsumi & Associates, Inc.
7/31/2009

	→	↘	↙	←	↖	↗	
Movement	EBT	EBR	WBL	WBT	NBL	NBR	
Lane Configurations	↑↑		↘	↑↑	↘	↘	
Volume (veh/h)	415	25	120	1070	35	70	
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)	451	27	130	1163	38	76	
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			478		1307	239	
vC1, stage 1 conf vol							
vC2, stage 2 conf vol							
vCu, unblocked vol			478		1307	239	
tC, single (s)			4.1		6.8	6.9	
tC, 2 stage (s)							
tF (s)			2.2		3.5	3.3	
p0 queue free %			88		71	90	
cM capacity (veh/h)			1080		133	762	
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	WB 3	NB 1	NB 2
Volume Total	301	178	130	582	582	38	76
Volume Left	0	0	130	0	0	38	0
Volume Right	0	27	0	0	0	0	76
cSH	1700	1700	1080	1700	1700	133	762
Volume to Capacity	0.18	0.10	0.12	0.34	0.34	0.29	0.10
Queue Length 95th (ft)	0	0	10	0	0	28	8
Control Delay (s)	0.0	0.0	8.8	0.0	0.0	42.6	10.2
Lane LOS			A			E	B
Approach Delay (s)	0.0		0.9			21.0	
Approach LOS						C	
Intersection Summary							
Average Delay			1.9				
Intersection Capacity Utilization			39.6%	ICU Level of Service	A		
Analysis Period (min)			15				

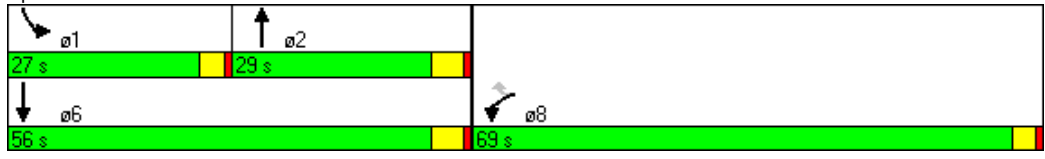
Timings
7: Wailea Ike Dr. & Wailea Alanui Dr.

Austin, Tsutsumi & Associates, Inc.
7/31/2009

	↙	↖	↑	↗	↘	↓
Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↙	↖	↑	↗	↘	↕
Volume (vph)	840	185	170	285	140	420
Turn Type	Perm		Free		Prot	
Protected Phases	8		2		1	6
Permitted Phases		8		Free		
Detector Phase	8	8	2		1	6
Switch Phase						
Minimum Initial (s)	4.0	4.0	4.0		4.0	4.0
Minimum Split (s)	22.0	22.0	24.0		10.0	24.0
Total Split (s)	69.0	69.0	29.0	0.0	27.0	56.0
Total Split (%)	55.2%	55.2%	23.2%	0.0%	21.6%	44.8%
Yellow Time (s)	3.0	3.0	4.0		3.0	4.0
All-Red Time (s)	1.0	1.0	1.0		1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	4.0	5.0	4.0	4.0	5.0
Lead/Lag			Lag		Lead	
Lead-Lag Optimize?			Yes		Yes	
Recall Mode	None	None	None		None	None
Act Effct Green (s)	62.0	62.0	16.0	105.9	14.6	34.7
Actuated g/C Ratio	0.59	0.59	0.15	1.00	0.14	0.33
v/c Ratio	0.88	0.20	0.66	0.20	0.62	0.39
Control Delay	32.2	4.6	55.4	0.3	56.3	28.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	32.2	4.6	55.4	0.3	56.3	28.4
LOS	C	A	E	A	E	C
Approach Delay	27.2		20.9			35.3
Approach LOS	C		C			D







Intersection Summary	
Cycle Length: 125	
Actuated Cycle Length: 105.9	
Natural Cycle: 90	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 0.88	
Intersection Signal Delay: 28.0	Intersection LOS: C
Intersection Capacity Utilization 74.1%	ICU Level of Service D
Analysis Period (min) 15	

Splits and Phases: 7: Wailea Ike Dr. & Wailea Alanui Dr.

























HCM Signalized Intersection Capacity Analysis
 7: Wailea Ike Dr. & Wailea Alanui Dr.

Austin, Tsutsumi & Associates, Inc.
 7/31/2009

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↵	↵	↑	↵	↵	↑↑
Volume (vph)	840	185	170	285	140	420
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	5.0	4.0	4.0	5.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	0.95
Fr _t	1.00	0.85	1.00	0.85	1.00	1.00
Fl _t Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1770	1583	1863	1583	1770	3539
Fl _t Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1770	1583	1863	1583	1770	3539
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	913	201	185	310	152	457
RTOR Reduction (vph)	0	60	0	0	0	0
Lane Group Flow (vph)	913	141	185	310	152	457
Turn Type		Perm		Free	Prot	
Protected Phases	8		2		1	6
Permitted Phases		8		Free		
Actuated Green, G (s)	62.0	62.0	16.1	105.7	14.6	34.7
Effective Green, g (s)	62.0	62.0	16.1	105.7	14.6	34.7
Actuated g/C Ratio	0.59	0.59	0.15	1.00	0.14	0.33
Clearance Time (s)	4.0	4.0	5.0		4.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	1038	929	284	1583	244	1162
v/s Ratio Prot	c0.52		c0.10		c0.09	0.13
v/s Ratio Perm		0.09		0.20		
v/c Ratio	0.88	0.15	0.65	0.20	0.62	0.39
Uniform Delay, d ₁	18.7	9.9	42.2	0.0	43.0	27.4
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d ₂	8.7	0.1	5.3	0.3	4.9	0.2
Delay (s)	27.3	10.0	47.4	0.3	47.8	27.6
Level of Service	C	A	D	A	D	C
Approach Delay (s)	24.2		17.9			32.7
Approach LOS	C		B			C
Intersection Summary						
HCM Average Control Delay			25.1		HCM Level of Service	C
HCM Volume to Capacity ratio			0.80			
Actuated Cycle Length (s)			105.7		Sum of lost time (s)	13.0
Intersection Capacity Utilization			74.1%		ICU Level of Service	D
Analysis Period (min)			15			
c Critical Lane Group						











HCM Unsignalized Intersection Capacity Analysis
 8: Okolani Dr & Wailea Alanui Dr.

Austin, Tsutsumi & Associates, Inc.
 7/31/2009

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control	Stop			Stop			Stop			Stop		
Volume (vph)	10	50	440	100	65	5	200	30	55	10	70	10
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	54	478	109	71	5	217	33	60	11	76	11
Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	NB 1	NB 2	NB 3	SB 1	SB 2		
Volume Total (vph)	11	54	478	179	5	217	33	60	87	11		
Volume Left (vph)	11	0	0	109	0	217	0	0	11	0		
Volume Right (vph)	0	0	478	0	5	0	0	60	0	11		
Hadj (s)	0.53	0.03	-0.67	0.34	-0.67	0.53	0.03	-0.67	0.10	-0.67		
Departure Headway (s)	6.2	5.7	3.2	5.9	4.9	5.9	5.4	3.2	5.6	4.8		
Degree Utilization, x	0.02	0.09	0.43	0.29	0.01	0.35	0.05	0.05	0.14	0.01		
Capacity (veh/h)	540	589	1115	586	694	594	641	1121	610	698		
Control Delay (s)	8.1	8.1	7.3	10.1	6.7	10.8	7.4	5.2	8.3	6.7		
Approach Delay (s)	7.4			10.0			9.4			8.1		
Approach LOS	A			A			A			A		
Intersection Summary												
Delay	8.4											
HCM Level of Service	A											
Intersection Capacity Utilization	50.4%			ICU Level of Service			A					
Analysis Period (min)	15											

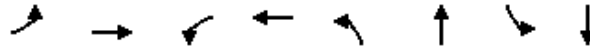
HCM Unsignalized Intersection Capacity Analysis
 9: Kilohana Dr & South Kihei Rd

Austin, Tsutsumi & Associates, Inc.
 7/31/2009

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	10	95	250	10	95	475
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	11	103	272	11	103	516
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)		1				
Median type			None			None
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1000	277			283	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1000	277			283	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	96	86			92	
cM capacity (veh/h)	248	762			1280	
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	114	283	620			
Volume Left	11	0	103			
Volume Right	103	11	0			
cSH	842	1700	1280			
Volume to Capacity	0.14	0.17	0.08			
Queue Length 95th (ft)	12	0	7			
Control Delay (s)	11.4	0.0	2.1			
Lane LOS	B		A			
Approach Delay (s)	11.4	0.0	2.1			
Approach LOS	B					
Intersection Summary						
Average Delay		2.6				
Intersection Capacity Utilization		57.3%		ICU Level of Service		B
Analysis Period (min)		15				

Timings
10: Grand Wailea Resort & Wailea Alanui Dr.

Austin, Tsutsumi & Associates, Inc.
7/31/2009



Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations		↕		↕	↗	↕↗	↗	↕↗
Volume (vph)	35	5	10	5	20	330	180	815
Turn Type	Perm		Perm		Perm		Perm	
Protected Phases		4		8		2		6
Permitted Phases	4		8		2		6	
Detector Phase	4	4	8	8	2	2	6	6
Switch Phase								
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	20.0	20.0	20.0	24.0	24.0	24.0	24.0
Total Split (s)	20.0	20.0	20.0	20.0	25.0	25.0	25.0	25.0
Total Split (%)	44.4%	44.4%	44.4%	44.4%	55.6%	55.6%	55.6%	55.6%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode	None	None	None	None	Min	Min	Min	Min
Act Effct Green (s)		6.7		6.5	27.4	27.4	27.4	27.4
Actuated g/C Ratio		0.20		0.19	0.81	0.81	0.81	0.81
v/c Ratio		0.16		0.20	0.05	0.14	0.25	0.35
Control Delay		10.9		7.7	4.4	2.9	4.9	3.6
Queue Delay		0.0		0.0	0.0	0.0	0.0	0.0
Total Delay		10.9		7.7	4.4	2.9	4.9	3.6
LOS		B		A	A	A	A	A
Approach Delay		10.9		7.7		3.0		3.8
Approach LOS		B		A		A		A

Intersection Summary



















Cycle Length: 45
 Actuated Cycle Length: 33.7
 Natural Cycle: 45
 Control Type: Actuated-Uncoordinated
 Maximum v/c Ratio: 0.35
 Intersection Signal Delay: 4.0
 Intersection LOS: A
 Intersection Capacity Utilization 51.1%
 ICU Level of Service A
 Analysis Period (min) 15

Splits and Phases: 10: Grand Wailea Resort & Wailea Alanui Dr.























HCM Signalized Intersection Capacity Analysis
 10: Grand Wailea Resort & Wailea Alanui Dr.

Austin, Tsutsumi & Associates, Inc.
 7/31/2009

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	35	5	15	10	5	50	20	330	25	180	815	100
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0			5.0		5.0	5.0		5.0	5.0	
Lane Util. Factor		1.00			1.00		1.00	0.95		1.00	0.95	
Flt Protected		0.96			0.90		1.00	0.99		1.00	0.98	
Flt Permitted		0.97			0.99		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1739			1656		1770	3502		1770	3481	
Satd. Flow (perm)		1795			1555		531	3502		975	3481	
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)	38	5	16	11	5	54	22	359	27	196	886	109
RTOR Reduction (vph)	0	15	0	0	50	0	0	8	0	0	13	0
Lane Group Flow (vph)	0	44	0	0	20	0	22	378	0	196	982	0
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)		2.8			2.8		24.1	24.1		24.1	24.1	
Effective Green, g (s)		2.8			2.8		24.1	24.1		24.1	24.1	
Actuated g/C Ratio		0.08			0.08		0.65	0.65		0.65	0.65	
Clearance Time (s)		5.0			5.0		5.0	5.0		5.0	5.0	
Vehicle Extension (s)		3.0			3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		136			118		347	2287		637	2273	
v/s Ratio Prot								0.11			c0.28	
v/s Ratio Perm		c0.02			0.01		0.04			0.20		
v/c Ratio		0.33			0.17		0.06	0.17		0.31	0.43	
Uniform Delay, d1		16.2			16.0		2.3	2.5		2.8	3.1	
Progression Factor		1.00			1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2		1.4			0.7		0.1	0.0		0.3	0.1	
Delay (s)		17.6			16.7		2.4	2.5		3.1	3.2	
Level of Service		B			B		A	A		A	A	
Approach Delay (s)		17.6			16.7			2.5			3.2	
Approach LOS		B			B			A			A	
Intersection Summary												
HCM Average Control Delay			4.1				HCM Level of Service			A		
HCM Volume to Capacity ratio			0.42									
Actuated Cycle Length (s)			36.9				Sum of lost time (s)		10.0			
Intersection Capacity Utilization			51.1%				ICU Level of Service		A			
Analysis Period (min)			15									
c Critical Lane Group												

HCM Unsignalized Intersection Capacity Analysis
 11: Kaukahi Dr & Wailea Alanui Dr.

Austin, Tsutsumi & Associates, Inc.
 7/31/2009

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	30	20	5	45	30	35	5	210	5	20	415	140
Sign Control		Stop			Stop			Free			Free	
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)	33	22	5	49	33	38	5	228	5	22	451	152
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	750	734	451	750	886	228	603			228		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	750	734	451	750	886	228	603			228		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	88	94	99	84	88	95	99			98		
cM capacity (veh/h)	279	340	608	304	277	811	974			1340		
Direction, Lane #	EB 1	WB 1	WB 2	NB 1	NB 2	SB 1	SB 2	SB 3				
Volume Total	60	82	38	234	5	22	451	152				
Volume Left	33	49	0	5	0	22	0	0				
Volume Right	5	0	38	0	5	0	0	152				
cSH	315	293	811	974	1700	1340	1700	1700				
Volume to Capacity	0.19	0.28	0.05	0.01	0.00	0.02	0.27	0.09				
Queue Length 95th (ft)	17	28	4	0	0	1	0	0				
Control Delay (s)	19.1	22.0	9.7	0.3	0.0	7.7	0.0	0.0				
Lane LOS	C	C	A	A		A						
Approach Delay (s)	19.1	18.1		0.3		0.3						
Approach LOS	C	C										
Intersection Summary												
Average Delay			3.4									
Intersection Capacity Utilization			38.5%		ICU Level of Service					A		
Analysis Period (min)			15									

Timings
1: Kilohana Dr & Piilani HWY

Austin, Tsutsumi & Associates, Inc.
7/31/2009



Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Configurations										
Volume (vph)	175	35	10	30	135	20	1355	160	1115	230
Turn Type	Perm		Perm		Perm	Prot		Prot		Perm
Protected Phases		4		8		5	2	1	6	
Permitted Phases	4		8		8					6
Detector Phase	4	4	8	8	8	5	2	1	6	6
Switch Phase										
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	12.0	12.0	12.0	12.0	12.0	10.0	24.0	10.0	24.0	24.0
Total Split (s)	25.0	25.0	25.0	25.0	25.0	10.0	49.0	16.0	55.0	55.0
Total Split (%)	27.8%	27.8%	27.8%	27.8%	27.8%	11.1%	54.4%	17.8%	61.1%	61.1%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	3.0	4.0	3.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	4.0	5.0	4.0	5.0	5.0
Lead/Lag						Lead	Lag	Lead	Lag	Lag
Lead-Lag Optimize?						Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	Min	Max	Min	Max	Max
Act Effct Green (s)	16.1	16.1		16.1	16.1	5.8	44.7	11.4	50.2	50.2
Actuated g/C Ratio	0.19	0.19		0.19	0.19	0.07	0.52	0.13	0.58	0.58
v/c Ratio	0.75	0.14		0.13	0.35	0.18	1.54	0.75	1.12	0.25
Control Delay	51.7	24.5		29.6	7.8	43.1	272.7	57.5	86.7	3.1
Queue Delay	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	51.7	24.5		29.6	7.8	43.1	272.7	57.5	86.7	3.1
LOS	D	C		C	A	D	F	E	F	A
Approach Delay		46.1		12.8			269.3		70.8	
Approach LOS		D		B			F		E	

Intersection Summary

Cycle Length: 90
 Actuated Cycle Length: 86.2
 Natural Cycle: 150
 Control Type: Actuated-Uncoordinated
 Maximum v/c Ratio: 1.54
 Intersection Signal Delay: 149.9
 Intersection LOS: F
 Intersection Capacity Utilization 109.1%
 ICU Level of Service H
 Analysis Period (min) 15

Splits and Phases: 1: Kilohana Dr & Piilani HWY



HCM Signalized Intersection Capacity Analysis
1: Kilohana Dr & Piilani HWY

Austin, Tsutsumi & Associates, Inc.
7/31/2009

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations													
Volume (vph)	175	35	10	10	30	135	20	1355	15	160	1115	230	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)	5.0	5.0			5.0	5.0	4.0	5.0		4.0	5.0	5.0	
Lane Util. Factor	1.00	1.00			1.00	1.00	1.00	1.00		1.00	1.00	1.00	
Flt Protected	1.00	0.97			1.00	0.85	1.00	1.00		1.00	1.00	0.85	
Flt Permitted	0.95	1.00			0.99	1.00	0.95	1.00		0.95	1.00	1.00	
Satd. Flow (prot)	1770	1800			1840	1583	1770	1860		1770	1863	1583	
Satd. Flow (perm)	1357	1800			1746	1583	1770	1860		1770	1863	1583	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	
Adj. Flow (vph)	190	38	11	11	33	147	22	1473	16	174	1212	250	
RTOR Reduction (vph)	0	9	0	0	0	120	0	0	0	0	0	85	
Lane Group Flow (vph)	190	40	0	0	44	27	22	1489	0	174	1212	165	
Turn Type	Perm			Perm		Perm	Prot			Prot		Perm	
Protected Phases		4			8		5	2		1	6		
Permitted Phases	4			8		8						6	
Actuated Green, G (s)	16.1	16.1			16.1	16.1	5.8	44.7		11.4	50.3	50.3	
Effective Green, g (s)	16.1	16.1			16.1	16.1	5.8	44.7		11.4	50.3	50.3	
Actuated g/C Ratio	0.19	0.19			0.19	0.19	0.07	0.52		0.13	0.58	0.58	
Clearance Time (s)	5.0	5.0			5.0	5.0	4.0	5.0		4.0	5.0	5.0	
Vehicle Extension (s)	3.0	3.0			3.0	3.0	3.0	3.0		3.0	3.0	3.0	
Lane Grp Cap (vph)	253	336			326	296	119	965		234	1087	924	
v/s Ratio Prot		0.02					0.01	c0.80		c0.10	c0.65		
v/s Ratio Perm	c0.14				0.03	0.02						0.10	
v/c Ratio	0.75	0.12			0.13	0.09	0.18	1.54		0.74	1.11	0.18	
Uniform Delay, d1	33.2	29.2			29.2	29.0	38.0	20.8		36.0	18.0	8.3	
Progression Factor	1.00	1.00			1.00	1.00	1.00	1.00		1.00	1.00	1.00	
Incremental Delay, d2	11.8	0.2			0.2	0.1	0.8	249.3		12.0	64.6	0.4	
Delay (s)	45.0	29.3			29.4	29.1	38.7	270.1		48.0	82.6	8.8	
Level of Service	D	C			C	C	D	F		D	F	A	
Approach Delay (s)		41.8			29.2			266.7			67.6		
Approach LOS		D			C			F			E		
Intersection Summary													
HCM Average Control Delay			147.9									HCM Level of Service	F
HCM Volume to Capacity ratio			1.34										
Actuated Cycle Length (s)			86.2									Sum of lost time (s)	19.0
Intersection Capacity Utilization			109.1%									ICU Level of Service	H
Analysis Period (min)			15										
c Critical Lane Group													

Timings
2: Okolani Dr. & Piilani HWY

Austin, Tsutsumi & Associates, Inc.
7/31/2009



Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗		↕	↖	↗	↗	↖	↗	↗
Volume (vph)	250	35	15	20	40	1035	40	80	765	270
Turn Type	Perm		Perm		Perm		Perm	Perm		Perm
Protected Phases		4		8		2			6	
Permitted Phases	4		8		2		2	6		6
Detector Phase	4	4	8	8	2	2	2	6	6	6
Switch Phase										
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0
Total Split (s)	28.0	28.0	28.0	28.0	62.0	62.0	62.0	62.0	62.0	62.0
Total Split (%)	31.1%	31.1%	31.1%	31.1%	68.9%	68.9%	68.9%	68.9%	68.9%	68.9%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag										
Lead-Lag Optimize?										
Recall Mode	None	None	None	None	Max	Max	Max	Max	Max	Max
Act Effct Green (s)	19.8	19.8		19.8	56.6	56.6	56.6	56.6	56.6	56.6
Actuated g/C Ratio	0.22	0.22		0.22	0.64	0.64	0.64	0.64	0.64	0.64
v/c Ratio	0.85	0.17		0.22	0.16	0.94	0.04	1.04	0.70	0.26
Control Delay	57.1	17.7		15.5	9.0	32.6	2.3	133.7	14.9	1.5
Queue Delay	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	57.1	17.7		15.5	9.0	32.6	2.3	133.7	14.9	1.5
LOS	E	B		B	A	C	A	F	B	A
Approach Delay		48.9		15.5		30.7			20.2	
Approach LOS		D		B		C			C	

Intersection Summary

Cycle Length: 90
 Actuated Cycle Length: 88.5
 Natural Cycle: 90
 Control Type: Actuated-Uncoordinated
 Maximum v/c Ratio: 1.04
 Intersection Signal Delay: 28.0
 Intersection LOS: C
 Intersection Capacity Utilization 94.4%
 ICU Level of Service F
 Analysis Period (min) 15

Splits and Phases: 2: Okolani Dr. & Piilani HWY



HCM Signalized Intersection Capacity Analysis
2: Okolani Dr. & Piilani HWY

Austin, Tsutsumi & Associates, Inc.
7/31/2009

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	250	35	30	15	20	45	40	1035	40	80	765	270
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0			6.0		6.0	6.0	6.0	6.0	6.0	6.0
Lane Util. Factor	1.00	1.00			1.00		1.00	1.00	1.00	1.00	1.00	1.00
Flt Protected	1.00	0.93			0.92		1.00	1.00	0.85	1.00	1.00	0.85
Flt Permitted	0.95	1.00			0.99		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	1733			1705		1770	1863	1583	1770	1863	1583
Satd. Flow (perm)	1433	1733			1625		409	1863	1583	132	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)	272	38	33	16	22	49	43	1125	43	87	832	293
RTOR Reduction (vph)	0	26	0	0	38	0	0	0	15	0	0	105
Lane Group Flow (vph)	272	45	0	0	49	0	43	1125	28	87	832	188
Turn Type	Perm			Perm			Perm		Perm	Perm		Perm
Protected Phases		4			8			2				6
Permitted Phases	4			8			2		2	6		6
Actuated Green, G (s)	19.8	19.8			19.8		56.6	56.6	56.6	56.6		56.6
Effective Green, g (s)	19.8	19.8			19.8		56.6	56.6	56.6	56.6		56.6
Actuated g/C Ratio	0.22	0.22			0.22		0.64	0.64	0.64	0.64		0.64
Clearance Time (s)	6.0	6.0			6.0		6.0	6.0	6.0	6.0		6.0
Vehicle Extension (s)	3.0	3.0			3.0		3.0	3.0	3.0	3.0		3.0
Lane Grp Cap (vph)	321	388			364		262	1193	1014	85	1193	1014
v/s Ratio Prot		0.03						0.60			0.45	
v/s Ratio Perm	c0.19				0.03		0.11		0.02	c0.66		0.12
v/c Ratio	0.85	0.12			0.13		0.16	0.94	0.03	1.02	0.70	0.19
Uniform Delay, d1	32.9	27.3			27.4		6.4	14.4	5.8	15.9	10.3	6.5
Progression Factor	1.00	1.00			1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	18.3	0.1			0.2		1.3	15.5	0.0	104.2	3.4	0.4
Delay (s)	51.1	27.5			27.6		7.7	30.0	5.9	120.1	13.7	6.9
Level of Service	D	C			C		A	C	A	F	B	A
Approach Delay (s)		46.2			27.6			28.3			19.7	
Approach LOS		D			C			C			B	
Intersection Summary												
HCM Average Control Delay			26.8				HCM Level of Service			C		
HCM Volume to Capacity ratio			0.98									
Actuated Cycle Length (s)			88.4				Sum of lost time (s)		12.0			
Intersection Capacity Utilization			94.4%				ICU Level of Service		F			
Analysis Period (min)			15									
c Critical Lane Group												

HCM Unsignalized Intersection Capacity Analysis
 4: Wailea Ike Dr. & Kalai Waa St

Austin, Tsutsumi & Associates, Inc.
 7/31/2009

	→	↘	↙	←	↖	↗	
Movement	EBT	EBR	WBL	WBT	NBL	NBR	
Lane Configurations	↑↑		↘	↑↑	↘	↗	
Volume (veh/h)	1035	75	110	730	65	150	
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)	1125	82	120	793	71	163	
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			1207		1802	603	
vC1, stage 1 conf vol							
vC2, stage 2 conf vol							
vCu, unblocked vol			1207		1802	603	
tC, single (s)			4.1		6.8	6.9	
tC, 2 stage (s)							
tF (s)			2.2		3.5	3.3	
p0 queue free %			79		0	63	
cM capacity (veh/h)			574		56	442	
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	WB 3	NB 1	NB 2
Volume Total	750	457	120	397	397	71	163
Volume Left	0	0	120	0	0	71	0
Volume Right	0	82	0	0	0	0	163
cSH	1700	1700	574	1700	1700	56	442
Volume to Capacity	0.44	0.27	0.21	0.23	0.23	1.26	0.37
Queue Length 95th (ft)	0	0	19	0	0	153	42
Control Delay (s)	0.0	0.0	12.9	0.0	0.0	326.3	17.8
Lane LOS			B			F	C
Approach Delay (s)	0.0	1.7				111.1	
Approach LOS							F
Intersection Summary							
Average Delay			11.7				
Intersection Capacity Utilization			50.7%		ICU Level of Service		A
Analysis Period (min)			15				

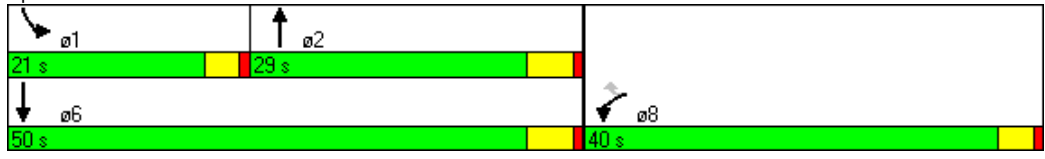
Timings
7: Wailea Ike Dr. & Wailea Alanui Dr.

Austin, Tsutsumi & Associates, Inc.
7/31/2009

	↙	↖	↑	↗	↘	↓
Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↙	↖	↑	↗	↘	↕
Volume (vph)	490	225	400	745	245	370
Turn Type	Perm			Free	Prot	
Protected Phases	8		2		1	6
Permitted Phases		8		Free		
Detector Phase	8	8	2		1	6
Switch Phase						
Minimum Initial (s)	4.0	4.0	4.0		4.0	4.0
Minimum Split (s)	22.0	22.0	24.0		10.0	24.0
Total Split (s)	40.0	40.0	29.0	0.0	21.0	50.0
Total Split (%)	44.4%	44.4%	32.2%	0.0%	23.3%	55.6%
Yellow Time (s)	3.0	3.0	4.0		3.0	4.0
All-Red Time (s)	1.0	1.0	1.0		1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	4.0	5.0	4.0	4.0	5.0
Lead/Lag			Lag		Lead	
Lead-Lag Optimize?			Yes		Yes	
Recall Mode	None	None	None		None	None
Act Effct Green (s)	28.6	28.6	21.9	79.3	15.4	41.4
Actuated g/C Ratio	0.36	0.36	0.28	1.00	0.19	0.52
v/c Ratio	0.84	0.34	0.85	0.51	0.77	0.22
Control Delay	36.3	3.9	45.9	1.2	49.4	11.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	36.3	3.9	45.9	1.2	49.4	11.5
LOS	D	A	D	A	D	B
Approach Delay	26.1		16.8			26.6
Approach LOS	C		B			C







Intersection Summary	
Cycle Length: 90	
Actuated Cycle Length: 79.3	
Natural Cycle: 70	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 0.85	
Intersection Signal Delay: 21.9	Intersection LOS: C
Intersection Capacity Utilization 72.6%	ICU Level of Service C
Analysis Period (min) 15	

Splits and Phases: 7: Wailea Ike Dr. & Wailea Alanui Dr.

























HCM Signalized Intersection Capacity Analysis
 7: Wailea Ike Dr. & Wailea Alanui Dr.

Austin, Tsutsumi & Associates, Inc.
 7/31/2009

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↶	↷	↑	↶	↷	↑↑
Volume (vph)	490	225	400	745	245	370
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	5.0	4.0	4.0	5.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	0.95
Flt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1770	1583	1863	1583	1770	3539
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1770	1583	1863	1583	1770	3539
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	533	245	435	810	266	402
RTOR Reduction (vph)	0	156	0	0	0	0
Lane Group Flow (vph)	533	89	435	810	266	402
Turn Type		Perm		Free	Prot	
Protected Phases	8		2		1	6
Permitted Phases		8		Free		
Actuated Green, G (s)	28.6	28.6	22.0	79.0	15.4	41.4
Effective Green, g (s)	28.6	28.6	22.0	79.0	15.4	41.4
Actuated g/C Ratio	0.36	0.36	0.28	1.00	0.19	0.52
Clearance Time (s)	4.0	4.0	5.0		4.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	641	573	519	1583	345	1855
v/s Ratio Prot	c0.30		c0.23		c0.15	0.11
v/s Ratio Perm		0.06		0.51		
v/c Ratio	0.83	0.15	0.84	0.51	0.77	0.22
Uniform Delay, d1	23.0	17.0	26.8	0.0	30.1	10.1
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	9.0	0.1	11.3	1.2	10.2	0.1
Delay (s)	32.0	17.2	38.1	1.2	40.3	10.2
Level of Service	C	B	D	A	D	B
Approach Delay (s)	27.3		14.1			22.2
Approach LOS	C		B			C
Intersection Summary						
HCM Average Control Delay			19.9		HCM Level of Service	B
HCM Volume to Capacity ratio			0.82			
Actuated Cycle Length (s)			79.0		Sum of lost time (s)	13.0
Intersection Capacity Utilization			72.6%		ICU Level of Service	C
Analysis Period (min)			15			
c Critical Lane Group						











HCM Unsignalized Intersection Capacity Analysis
 8: Okolani Dr & Wailea Alanui Dr.

Austin, Tsutsumi & Associates, Inc.
 7/31/2009

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control	Stop			Stop			Stop			Stop		
Volume (vph)	15	90	410	95	70	15	435	105	145	15	30	15
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)	16	98	446	103	76	16	473	114	158	16	33	16
Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	NB 1	NB 2	NB 3	SB 1	SB 2		
Volume Total (vph)	16	98	446	179	16	473	114	158	49	16		
Volume Left (vph)	16	0	0	103	0	473	0	0	16	0		
Volume Right (vph)	0	0	446	0	16	0	0	158	0	16		
Hadj (s)	0.53	0.03	-0.67	0.32	-0.67	0.53	0.03	-0.67	0.20	-0.67		
Departure Headway (s)	7.2	6.7	3.2	6.8	5.8	6.1	5.6	3.2	6.5	5.6		
Degree Utilization, x	0.03	0.18	0.40	0.34	0.03	0.80	0.18	0.14	0.09	0.03		
Capacity (veh/h)	464	501	1114	491	572	578	621	1121	521	594		
Control Delay (s)	9.2	9.9	7.1	12.1	7.8	28.3	8.6	5.5	8.9	7.6		
Approach Delay (s)	7.6			11.7			20.4			8.6		
Approach LOS	A			B			C			A		
Intersection Summary												
Delay			14.3									
HCM Level of Service			B									
Intersection Capacity Utilization			53.0%		ICU Level of Service		A					
Analysis Period (min)			15									

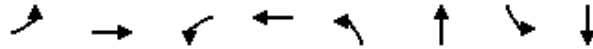
HCM Unsignalized Intersection Capacity Analysis
 9: Kilohana Dr & South Kihei Rd

Austin, Tsutsumi & Associates, Inc.
 7/31/2009

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	35	150	500	25	100	490
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	38	163	543	27	109	533
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)		1				
Median type			None			None
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1307	557			571	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1307	557			571	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	76	69			89	
cM capacity (veh/h)	157	530			1002	
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	201	571	641			
Volume Left	38	0	109			
Volume Right	163	27	0			
cSH	653	1700	1002			
Volume to Capacity	0.31	0.34	0.11			
Queue Length 95th (ft)	33	0	9			
Control Delay (s)	18.6	0.0	2.7			
Lane LOS	C		A			
Approach Delay (s)	18.6	0.0	2.7			
Approach LOS	C					
Intersection Summary						
Average Delay			3.9			
Intersection Capacity Utilization		72.5%		ICU Level of Service		C
Analysis Period (min)			15			

Timings
10: Grand Wailea Resort & Wailea Alanui Dr.

Austin, Tsutsumi & Associates, Inc.
7/31/2009

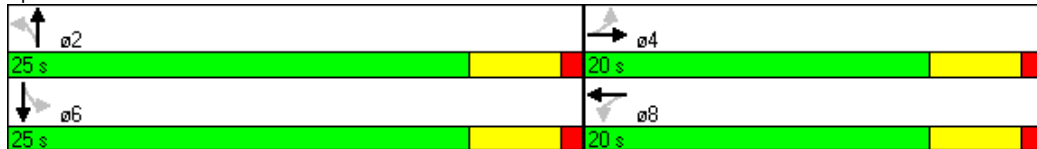


Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations		↕		↕	↖	↗	↖	↗
Volume (vph)	105	5	10	15	30	860	60	555
Turn Type	Perm		Perm		Perm		Perm	
Protected Phases		4		8		2		6
Permitted Phases	4		8		2		6	
Detector Phase	4	4	8	8	2	2	6	6
Switch Phase								
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	20.0	20.0	20.0	24.0	24.0	24.0	24.0
Total Split (s)	20.0	20.0	20.0	20.0	25.0	25.0	25.0	25.0
Total Split (%)	44.4%	44.4%	44.4%	44.4%	55.6%	55.6%	55.6%	55.6%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode	None	None	None	None	Min	Min	Min	Min
Act Effct Green (s)		9.0		9.0	22.4	22.4	22.4	22.4
Actuated g/C Ratio		0.24		0.24	0.60	0.60	0.60	0.60
v/c Ratio		0.44		0.18	0.07	0.45	0.21	0.32
Control Delay		14.8		7.2	6.8	7.4	8.9	6.2
Queue Delay		0.0		0.0	0.0	0.0	0.0	0.0
Total Delay		14.8		7.2	6.8	7.4	8.9	6.2
LOS		B		A	A	A	A	A
Approach Delay		14.8		7.2		7.4		6.5
Approach LOS		B		A		A		A

Intersection Summary

Cycle Length: 45
 Actuated Cycle Length: 37.5
 Natural Cycle: 45
 Control Type: Actuated-Uncoordinated
 Maximum v/c Ratio: 0.45
 Intersection Signal Delay: 7.6
 Intersection LOS: A
 Intersection Capacity Utilization 54.2%
 ICU Level of Service A
 Analysis Period (min) 15

Splits and Phases: 10: Grand Wailea Resort & Wailea Alanui Dr.























HCM Signalized Intersection Capacity Analysis
 10: Grand Wailea Resort & Wailea Alanui Dr.

Austin, Tsutsumi & Associates, Inc.
 7/31/2009

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations													
Volume (vph)	105	5	25	10	15	45	30	860	10	60	555	65	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)		5.0			5.0		5.0	5.0		5.0	5.0		
Lane Util. Factor		1.00			1.00		1.00	0.95		1.00	0.95		
Flt Protected		0.98			0.91		1.00	1.00		1.00	0.98		
Flt Permitted		0.96			0.99		0.95	1.00		0.95	1.00		
Satd. Flow (prot)		1748			1688		1770	3533		1770	3483		
Satd. Flow (perm)		1313			1582		737	3533		518	3483		
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)	114	5	27	11	16	49	33	935	11	65	603	71	
RTOR Reduction (vph)	0	22	0	0	39	0	0	1	0	0	16	0	
Lane Group Flow (vph)	0	124	0	0	37	0	33	945	0	65	658	0	
Turn Type	Perm			Perm			Perm			Perm			
Protected Phases		4			8			2			6		
Permitted Phases	4			8			2			6			
Actuated Green, G (s)		7.5			7.5		21.1	21.1		21.1	21.1		
Effective Green, g (s)		7.5			7.5		21.1	21.1		21.1	21.1		
Actuated g/C Ratio		0.19			0.19		0.55	0.55		0.55	0.55		
Clearance Time (s)		5.0			5.0		5.0	5.0		5.0	5.0		
Vehicle Extension (s)		3.0			3.0		3.0	3.0		3.0	3.0		
Lane Grp Cap (vph)		255			307		403	1931		283	1904		
v/s Ratio Prot								c0.27			0.19		
v/s Ratio Perm		c0.09			0.02		0.04			0.13			
v/c Ratio		0.49			0.12		0.08	0.49		0.23	0.35		
Uniform Delay, d1		13.8			12.8		4.2	5.4		4.5	4.9		
Progression Factor		1.00			1.00		1.00	1.00		1.00	1.00		
Incremental Delay, d2		1.5			0.2		0.1	0.2		0.4	0.1		
Delay (s)		15.3			13.0		4.2	5.6		5.0	5.0		
Level of Service		B			B		A	A		A	A		
Approach Delay (s)		15.3			13.0			5.6			5.0		
Approach LOS		B			B			A			A		
Intersection Summary													
HCM Average Control Delay			6.4									HCM Level of Service	A
HCM Volume to Capacity ratio			0.49										
Actuated Cycle Length (s)			38.6									Sum of lost time (s)	10.0
Intersection Capacity Utilization			54.2%									ICU Level of Service	A
Analysis Period (min)			15										
c Critical Lane Group													

HCM Unsignalized Intersection Capacity Analysis
 11: Kaukahi Dr & Wailea Alanui Dr.

Austin, Tsutsumi & Associates, Inc.
 7/31/2009

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	90	25	10	30	15	5	10	530	45	35	420	65
Sign Control		Stop			Stop			Free			Free	
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)	98	27	11	33	16	5	11	576	49	38	457	71
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	1139	1130	457	1155	1201	576	527			576		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1139	1130	457	1155	1201	576	527			576		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	38	86	98	78	91	99	99			96		
cM capacity (veh/h)	158	194	604	147	176	517	1040			997		
Direction, Lane #	EB 1	WB 1	WB 2	NB 1	NB 2	SB 1	SB 2	SB 3				
Volume Total	136	49	5	587	49	38	457	71				
Volume Left	98	33	0	11	0	38	0	0				
Volume Right	11	0	5	0	49	0	0	71				
cSH	175	155	517	1040	1700	997	1700	1700				
Volume to Capacity	0.78	0.31	0.01	0.01	0.03	0.04	0.27	0.04				
Queue Length 95th (ft)	128	31	1	1	0	3	0	0				
Control Delay (s)	74.0	38.4	12.0	0.3	0.0	8.8	0.0	0.0				
Lane LOS	F	E	B	A		A						
Approach Delay (s)	74.0	35.8		0.3		0.6						
Approach LOS	F	E										
Intersection Summary												
Average Delay				9.0								
Intersection Capacity Utilization			56.1%		ICU Level of Service					B		
Analysis Period (min)			15									

Timings
1: Kilohana Dr & Piilani HWY

Austin, Tsutsumi & Associates, Inc.
1/13/2010

	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	155	20	15	25	155	5	685	5	50	1240	150
Turn Type	Perm		Perm		Perm	Prot		Perm	Prot		Perm
Protected Phases		4		8		5	2		1	6	
Permitted Phases	4		8		8			2			6
Detector Phase	4	4	8	8	8	5	2	2	1	6	6
Switch Phase											
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	12.0	12.0	12.0	12.0	12.0	10.0	24.0	24.0	10.0	24.0	24.0
Total Split (s)	17.0	17.0	17.0	17.0	17.0	10.0	31.0	31.0	12.0	33.0	33.0
Total Split (%)	28.3%	28.3%	28.3%	28.3%	28.3%	16.7%	51.7%	51.7%	20.0%	55.0%	55.0%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	3.0	4.0	4.0	3.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	4.0	5.0	5.0	4.0	5.0	5.0
Lead/Lag						Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?											
Recall Mode	None	None	None	None	None	None	Max	Max	None	Max	Max

Intersection Summary

Cycle Length: 60
 Actuated Cycle Length: 54.9
 Natural Cycle: 60
 Control Type: Actuated-Uncoordinated

Splits and Phases: 1: Kilohana Dr & Piilani HWY



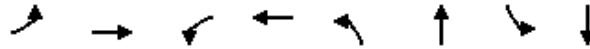
HCM Signalized Intersection Capacity Analysis
1: Kilohana Dr & Piilani HWY

Austin, Tsutsumi & Associates, Inc.
1/13/2010

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	155	20	10	15	25	155	5	685	5	50	1240	150
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0	5.0	4.0	5.0	5.0	4.0	5.0	5.0
Lane Util. Factor	1.00	1.00		1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Flt Protected	1.00	0.95		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	1770		1770	1863	1583	1770	3539	1583	1770	3539	1583
Satd. Flow (perm)	1378	1770		1370	1863	1583	1770	3539	1583	1770	3539	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)	168	22	11	16	27	168	5	745	5	54	1348	163
RTOR Reduction (vph)	0	9	0	0	0	143	0	0	2	0	0	66
Lane Group Flow (vph)	168	24	0	16	27	25	5	745	3	54	1348	97
Turn Type	Perm			Perm		Perm	Prot		Perm	Prot		Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8		8			2			6
Actuated Green, G (s)	8.8	8.8		8.8	8.8	8.8	1.1	32.1	32.1	4.3	35.3	35.3
Effective Green, g (s)	8.8	8.8		8.8	8.8	8.8	1.1	32.1	32.1	4.3	35.3	35.3
Actuated g/C Ratio	0.15	0.15		0.15	0.15	0.15	0.02	0.54	0.54	0.07	0.60	0.60
Clearance Time (s)	5.0	5.0		5.0	5.0	5.0	4.0	5.0	5.0	4.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	205	263		204	277	235	33	1919	858	129	2110	944
v/s Ratio Prot		0.01			0.01		0.00	0.21		c0.03	c0.38	
v/s Ratio Perm	c0.12			0.01		0.02			0.00			0.06
v/c Ratio	0.82	0.09		0.08	0.10	0.11	0.15	0.39	0.00	0.42	0.64	0.10
Uniform Delay, d1	24.4	21.7		21.7	21.8	21.8	28.6	7.9	6.2	26.3	7.8	5.1
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	21.9	0.1		0.2	0.2	0.2	2.1	0.6	0.0	2.2	1.5	0.2
Delay (s)	46.3	21.9		21.9	21.9	22.0	30.7	8.5	6.2	28.4	9.3	5.4
Level of Service	D	C		C	C	C	C	A	A	C	A	A
Approach Delay (s)		42.3			22.0			8.6			9.5	
Approach LOS		D			C			A			A	
Intersection Summary												
HCM Average Control Delay			12.6									HCM Level of Service B
HCM Volume to Capacity ratio			0.68									
Actuated Cycle Length (s)			59.2									Sum of lost time (s) 14.0
Intersection Capacity Utilization			64.5%									ICU Level of Service C
Analysis Period (min)			15									
c Critical Lane Group												

Timings
2: Okolani Dr. & Piilani HWY

Austin, Tsutsumi & Associates, Inc.
7/31/2009

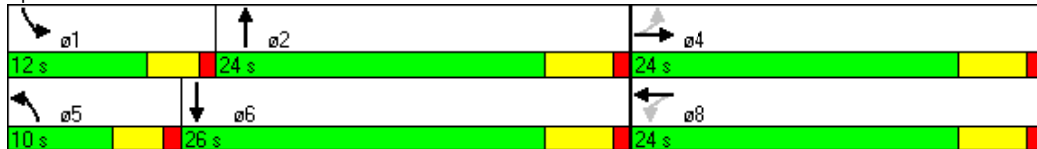


Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations	↖	↗		↕	↖	↗	↖	↗
Volume (vph)	185	15	35	20	10	440	35	1055
Turn Type	Perm		Perm		Prot		Prot	
Protected Phases		4		8	5	2	1	6
Permitted Phases	4		8					
Detector Phase	4	4	8	8	5	2	1	6
Switch Phase								
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	24.0	24.0	24.0	24.0	10.0	24.0	10.0	24.0
Total Split (s)	24.0	24.0	24.0	24.0	10.0	24.0	12.0	26.0
Total Split (%)	40.0%	40.0%	40.0%	40.0%	16.7%	40.0%	20.0%	43.3%
Yellow Time (s)	4.0	4.0	4.0	4.0	3.0	4.0	3.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	4.0	5.0	4.0	5.0
Lead/Lag					Lead	Lag	Lead	Lag
Lead-Lag Optimize?								
Recall Mode	None	None	None	None	None	Max	None	Max
Act Effct Green (s)	12.5	12.5		12.5	5.9	23.7	6.6	26.0
Actuated g/C Ratio	0.25	0.25		0.25	0.12	0.47	0.13	0.51
v/c Ratio	0.58	0.10		0.31	0.05	0.30	0.16	0.72
Control Delay	23.6	9.2		9.6	23.4	11.4	22.9	15.6
Queue Delay	0.0	0.0		0.0	0.0	0.0	0.0	0.0
Total Delay	23.6	9.2		9.6	23.4	11.4	22.9	15.6
LOS	C	A		A	C	B	C	B
Approach Delay		21.1		9.6		11.7		15.8
Approach LOS		C		A		B		B

Intersection Summary




















Cycle Length: 60
 Actuated Cycle Length: 50.5
 Natural Cycle: 65
 Control Type: Actuated-Uncoordinated
 Maximum v/c Ratio: 0.72
 Intersection Signal Delay: 15.1
 Intersection LOS: B
 Intersection Capacity Utilization 58.7%
 ICU Level of Service B
 Analysis Period (min) 15

Splits and Phases: 2: Okolani Dr. & Piilani HWY
























HCM Signalized Intersection Capacity Analysis
2: Okolani Dr. & Piilani HWY

Austin, Tsutsumi & Associates, Inc.
7/31/2009

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations													
Volume (vph)	185	15	25	35	20	70	10	440	15	35	1055	135	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)	5.0	5.0			5.0		4.0	5.0		4.0	5.0		
Lane Util. Factor	1.00	1.00			1.00		1.00	0.95		1.00	0.95		
Flt Protected	1.00	0.91			0.92		1.00	1.00		1.00	0.98		
Flt Permitted	0.95	1.00			0.99		0.95	1.00		0.95	1.00		
Satd. Flow (prot)	1770	1687			1698		1770	3522		1770	3479		
Satd. Flow (perm)	1395	1687			1562		1770	3522		1770	3479		
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	16	27	38	22	76	11	478	16	38	1147	147	
RTOR Reduction (vph)	0	21	0	0	58	0	0	3	0	0	13	0	
Lane Group Flow (vph)	201	22	0	0	78	0	11	491	0	38	1281	0	
Turn Type	Perm		Perm				Prot		Prot				
Protected Phases	4		8				5		2		1		6
Permitted Phases	4		8										
Actuated Green, G (s)	12.5	12.5			12.5		1.0	24.3		2.7	26.0		
Effective Green, g (s)	12.5	12.5			12.5		1.0	24.3		2.7	26.0		
Actuated g/C Ratio	0.23	0.23			0.23		0.02	0.45		0.05	0.49		
Clearance Time (s)	5.0	5.0			5.0		4.0	5.0		4.0	5.0		
Vehicle Extension (s)	3.0	3.0			3.0		3.0	3.0		3.0	3.0		
Lane Grp Cap (vph)	326	394			365		33	1600		89	1691		
v/s Ratio Prot		0.01					0.01	0.14		c0.02	c0.37		
v/s Ratio Perm	c0.14				0.05								
v/c Ratio	0.62	0.06			0.21		0.33	0.31		0.43	0.76		
Uniform Delay, d1	18.4	15.9			16.5		25.9	9.3		24.6	11.2		
Progression Factor	1.00	1.00			1.00		1.00	1.00		1.00	1.00		
Incremental Delay, d2	3.4	0.1			0.3		5.9	0.5		3.3	3.2		
Delay (s)	21.8	16.0			16.8		31.8	9.8		27.9	14.4		
Level of Service	C	B			B		C	A		C	B		
Approach Delay (s)	20.8		16.8				10.2		14.8				
Approach LOS	C		B				B		B				
Intersection Summary													
HCM Average Control Delay	14.5		HCM Level of Service				B						
HCM Volume to Capacity ratio	0.64												
Actuated Cycle Length (s)	53.5		Sum of lost time (s)				9.0						
Intersection Capacity Utilization	58.7%		ICU Level of Service				B						
Analysis Period (min)	15												
c Critical Lane Group													

HCM Unsignalized Intersection Capacity Analysis
 11: Kaukahi Dr & Wailea Alanui Dr.

Austin, Tsutsumi & Associates, Inc.
 7/31/2009

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	30	20	5	45	30	35	5	210	5	20	415	140
Sign Control		Stop			Stop			Free			Free	
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)	33	22	5	49	33	38	5	228	5	22	451	152
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type												
Median storage veh												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	750	734	451	750	886	228	603			228		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	750	734	451	750	886	228	603			228		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	88	94	99	84	88	95	99			98		
cM capacity (veh/h)	279	340	608	304	277	811	974			1340		
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2	SB 1	SB 2	SB 3			
Volume Total	33	27	82	38	234	5	22	451	152			
Volume Left	33	0	49	0	5	0	22	0	0			
Volume Right	0	5	0	38	0	5	0	0	152			
cSH	279	373	293	811	974	1700	1340	1700	1700			
Volume to Capacity	0.12	0.07	0.28	0.05	0.01	0.00	0.02	0.27	0.09			
Queue Length 95th (ft)	10	6	28	4	0	0	1	0	0			
Control Delay (s)	19.6	15.4	22.0	9.7	0.3	0.0	7.7	0.0	0.0			
Lane LOS	C	C	C	A	A		A					
Approach Delay (s)	17.7		18.1		0.3		0.3					
Approach LOS	C		C									
Intersection Summary												
Average Delay			3.3									
Intersection Capacity Utilization			39.2%		ICU Level of Service				A			
Analysis Period (min)			15									

Timings
1: Kilohana Dr & Piilani HWY

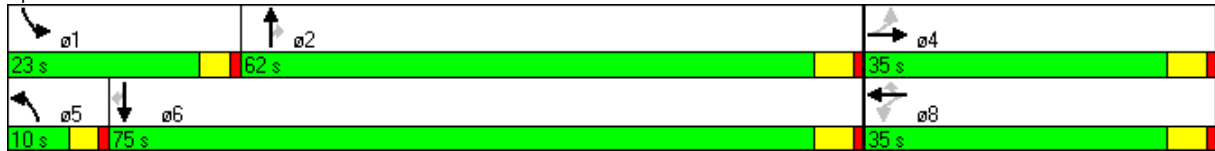
Austin, Tsutsumi & Associates, Inc.
1/13/2010

	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	175	35	10	30	135	20	1355	15	160	1115	230
Turn Type	Perm		Perm		Perm	Prot		Perm	Prot		Perm
Protected Phases		4		8		5	2		1	6	
Permitted Phases	4		8		8			2			6
Detector Phase	4	4	8	8	8	5	2	2	1	6	6
Switch Phase											
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	12.0	12.0	12.0	12.0	12.0	10.0	24.0	24.0	10.0	24.0	24.0
Total Split (s)	35.0	35.0	35.0	35.0	35.0	10.0	62.0	62.0	23.0	75.0	75.0
Total Split (%)	29.2%	29.2%	29.2%	29.2%	29.2%	8.3%	51.7%	51.7%	19.2%	62.5%	62.5%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	3.0	4.0	4.0	3.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	4.0	5.0	5.0	4.0	5.0	5.0
Lead/Lag						Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?											
Recall Mode	None	None	None	None	None	Min	Max	Max	Min	None	None

Intersection Summary
























Cycle Length: 120
 Actuated Cycle Length: 106.6
 Natural Cycle: 60
 Control Type: Actuated-Uncoordinated

Splits and Phases: 1: Kilohana Dr & Piilani HWY



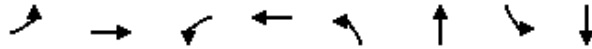
HCM Signalized Intersection Capacity Analysis
1: Kilohana Dr & Piilani HWY

Austin, Tsutsumi & Associates, Inc.
1/13/2010

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations													
Volume (vph)	175	35	10	10	30	135	20	1355	15	160	1115	230	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)	5.0	5.0		5.0	5.0	5.0	4.0	5.0	5.0	4.0	5.0	5.0	
Lane Util. Factor	1.00	1.00		1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Flt Protected	1.00	0.97		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1770	1800		1770	1863	1583	1770	3539	1583	1770	3539	1583	
Satd. Flow (perm)	1370	1800		1351	1863	1583	1770	3539	1583	1770	3539	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)	190	38	11	11	33	147	22	1473	16	174	1212	250	
RTOR Reduction (vph)	0	9	0	0	0	119	0	0	6	0	0	94	
Lane Group Flow (vph)	190	40	0	11	33	28	22	1473	10	174	1212	156	
Turn Type	Perm			Perm		Perm	Prot		Perm	Prot		Perm	
Protected Phases		4			8		5	2		1	6		
Permitted Phases	4			8		8			2			6	
Actuated Green, G (s)	20.0	20.0		20.0	20.0	20.0	5.9	57.5	57.5	15.0	66.6	66.6	
Effective Green, g (s)	20.0	20.0		20.0	20.0	20.0	5.9	57.5	57.5	15.0	66.6	66.6	
Actuated g/C Ratio	0.19	0.19		0.19	0.19	0.19	0.06	0.54	0.54	0.14	0.63	0.63	
Clearance Time (s)	5.0	5.0		5.0	5.0	5.0	4.0	5.0	5.0	4.0	5.0	5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	257	338		254	350	297	98	1911	855	249	2213	990	
v/s Ratio Prot		0.02			0.02		0.01	c0.42		c0.10	0.34		
v/s Ratio Perm	c0.14			0.01		0.02			0.01			0.10	
v/c Ratio	0.74	0.12		0.04	0.09	0.09	0.22	0.77	0.01	0.70	0.55	0.16	
Uniform Delay, d1	40.8	35.9		35.4	35.8	35.8	48.1	19.3	11.3	43.6	11.4	8.3	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	10.6	0.2		0.1	0.1	0.1	1.2	3.1	0.0	8.3	0.3	0.1	
Delay (s)	51.4	36.1		35.5	35.9	35.9	49.3	22.4	11.4	51.9	11.6	8.4	
Level of Service	D	D		D	D	D	D	C	B	D	B	A	
Approach Delay (s)		48.3			35.9			22.7			15.4		
Approach LOS		D			D			C			B		
Intersection Summary													
HCM Average Control Delay			21.8									HCM Level of Service	C
HCM Volume to Capacity ratio			0.75										
Actuated Cycle Length (s)			106.5									Sum of lost time (s)	14.0
Intersection Capacity Utilization			74.3%									ICU Level of Service	D
Analysis Period (min)			15										
c Critical Lane Group													

Timings
2: Okolani Dr. & Piilani HWY

Austin, Tsutsumi & Associates, Inc.
7/31/2009



Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Volume (vph)	250	35	15	20	40	1035	80	765
Turn Type	Perm		Perm		Prot		Prot	
Protected Phases		4		8	5	2	1	6
Permitted Phases	4		8					
Detector Phase	4	4	8	8	5	2	1	6
Switch Phase								
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	24.0	24.0	24.0	24.0	10.0	24.0	10.0	24.0
Total Split (s)	27.0	27.0	27.0	27.0	12.0	39.0	14.0	41.0
Total Split (%)	33.8%	33.8%	33.8%	33.8%	15.0%	48.8%	17.5%	51.3%
Yellow Time (s)	4.0	4.0	4.0	4.0	3.0	4.0	3.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	4.0	5.0	4.0	5.0
Lead/Lag					Lead	Lag	Lead	Lag
Lead-Lag Optimize?								
Recall Mode	None	None	None	None	None	Max	None	Max
Act Effct Green (s)	18.1	18.1		18.1	7.0	36.0	8.4	39.5
Actuated g/C Ratio	0.24	0.24		0.24	0.09	0.48	0.11	0.53
v/c Ratio	0.78	0.16		0.20	0.26	0.68	0.43	0.61
Control Delay	43.0	14.7		13.1	37.2	19.3	39.3	14.9
Queue Delay	0.0	0.0		0.0	0.0	0.0	0.0	0.0
Total Delay	43.0	14.7		13.1	37.2	19.3	39.3	14.9
LOS	D	B		B	D	B	D	B
Approach Delay		37.2		13.1		19.9		16.7
Approach LOS		D		B		B		B

Intersection Summary




















Cycle Length: 80
 Actuated Cycle Length: 74.3
 Natural Cycle: 60
 Control Type: Actuated-Uncoordinated
 Maximum v/c Ratio: 0.78
 Intersection Signal Delay: 20.4
 Intersection LOS: C
 Intersection Capacity Utilization 66.5%
 ICU Level of Service C
 Analysis Period (min) 15

Splits and Phases: 2: Okolani Dr. & Piilani HWY



HCM Signalized Intersection Capacity Analysis
2: Okolani Dr. & Piilani HWY

Austin, Tsutsumi & Associates, Inc.
7/31/2009

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	250	35	30	15	20	45	40	1035	40	80	765	270
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0			5.0		4.0	5.0		4.0	5.0	
Lane Util. Factor	1.00	1.00			1.00		1.00	0.95		1.00	0.95	
Flt Protected	1.00	0.93			0.92		1.00	0.99		1.00	0.96	
Flt Permitted	0.95	1.00			0.99		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1733			1705		1770	3520		1770	3401	
Satd. Flow (perm)	1436	1733			1633		1770	3520		1770	3401	
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)	272	38	33	16	22	49	43	1125	43	87	832	293
RTOR Reduction (vph)	0	25	0	0	37	0	0	3	0	0	38	0
Lane Group Flow (vph)	272	46	0	0	50	0	43	1165	0	87	1087	0
Turn Type	Perm			Perm			Prot			Prot		
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8								
Actuated Green, G (s)	18.1	18.1			18.1		4.4	36.9		7.0	39.5	
Effective Green, g (s)	18.1	18.1			18.1		4.4	36.9		7.0	39.5	
Actuated g/C Ratio	0.24	0.24			0.24		0.06	0.49		0.09	0.52	
Clearance Time (s)	5.0	5.0			5.0		4.0	5.0		4.0	5.0	
Vehicle Extension (s)	3.0	3.0			3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	342	413			389		102	1709		163	1768	
v/s Ratio Prot		0.03					0.02	c0.33		c0.05	c0.32	
v/s Ratio Perm	c0.19				0.03							
v/c Ratio	0.80	0.11			0.13		0.42	0.68		0.53	0.61	
Uniform Delay, d1	27.2	22.7			22.7		34.6	15.0		32.9	12.9	
Progression Factor	1.00	1.00			1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	12.0	0.1			0.1		2.8	2.2		3.3	1.6	
Delay (s)	39.3	22.8			22.9		37.4	17.3		36.3	14.5	
Level of Service	D	C			C		D	B		D	B	
Approach Delay (s)		35.8			22.9			18.0			16.1	
Approach LOS		D			C			B			B	
Intersection Summary												
HCM Average Control Delay			19.5				HCM Level of Service			B		
HCM Volume to Capacity ratio			0.75									
Actuated Cycle Length (s)			76.0				Sum of lost time (s)		19.0			
Intersection Capacity Utilization			66.5%				ICU Level of Service		C			
Analysis Period (min)			15									
c Critical Lane Group												

HCM Unsignalized Intersection Capacity Analysis
 11: Kaukahi Dr & Wailea Alanui Dr.

Austin, Tsutsumi & Associates, Inc.
 7/31/2009

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	90	25	10	30	15	5	10	530	45	35	420	65
Sign Control		Stop			Stop			Free			Free	
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)	98	27	11	33	16	5	11	576	49	38	457	71
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	1139	1130	457	1155	1201	576	527			576		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1139	1130	457	1155	1201	576	527			576		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	38	86	98	78	91	99	99			96		
cM capacity (veh/h)	158	194	604	147	176	517	1040			997		
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2	SB 1	SB 2	SB 3			
Volume Total	98	38	49	5	587	49	38	457	71			
Volume Left	98	0	33	0	11	0	38	0	0			
Volume Right	0	11	0	5	0	49	0	0	71			
cSH	158	240	155	517	1040	1700	997	1700	1700			
Volume to Capacity	0.62	0.16	0.31	0.01	0.01	0.03	0.04	0.27	0.04			
Queue Length 95th (ft)	84	14	31	1	1	0	3	0	0			
Control Delay (s)	59.0	22.8	38.4	12.0	0.3	0.0	8.8	0.0	0.0			
Lane LOS	F	C	E	B	A		A					
Approach Delay (s)	48.9		35.8		0.3		0.6					
Approach LOS	E		E									
Intersection Summary												
Average Delay			6.5									
Intersection Capacity Utilization			54.2%		ICU Level of Service				A			
Analysis Period (min)			15									



APPENDIX C

LEVEL OF SERVICE CALCULATIONS

- Base Year 2018 WITHOUT Project
-

Timings
1: Kilohana Dr & Piilani HWY

Austin, Tsutsumi & Associates, Inc.
1/13/2010

	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	155	20	15	30	155	5	750	5	50	1390	150
Turn Type	Perm		Perm		Perm	Prot		Perm	Prot		Perm
Protected Phases		4		8		5	2		1	6	
Permitted Phases	4		8		8			2			6
Detector Phase	4	4	8	8	8	5	2	2	1	6	6
Switch Phase											
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	12.0	12.0	12.0	12.0	12.0	10.0	24.0	24.0	10.0	24.0	24.0
Total Split (s)	17.0	17.0	17.0	17.0	17.0	10.0	31.0	31.0	12.0	33.0	33.0
Total Split (%)	28.3%	28.3%	28.3%	28.3%	28.3%	16.7%	51.7%	51.7%	20.0%	55.0%	55.0%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	3.0	4.0	4.0	3.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	4.0	5.0	5.0	4.0	5.0	5.0
Lead/Lag						Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?											
Recall Mode	None	None	None	None	None	None	Max	Max	None	Max	Max

Intersection Summary
























Cycle Length: 60
 Actuated Cycle Length: 54.9
 Natural Cycle: 60
 Control Type: Actuated-Uncoordinated

Splits and Phases: 1: Kilohana Dr & Piilani HWY



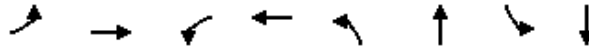
HCM Signalized Intersection Capacity Analysis
1: Kilohana Dr & Piilani HWY

Austin, Tsutsumi & Associates, Inc.
1/13/2010

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	155	20	10	15	30	155	5	750	5	50	1390	150
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0	5.0	4.0	5.0	5.0	4.0	5.0	5.0
Lane Util. Factor	1.00	1.00		1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Flt Protected	1.00	0.95		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	1770		1770	1863	1583	1770	3539	1583	1770	3539	1583
Satd. Flow (perm)	1370	1770		1370	1863	1583	1770	3539	1583	1770	3539	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)	168	22	11	16	33	168	5	815	5	54	1511	163
RTOR Reduction (vph)	0	9	0	0	0	143	0	0	2	0	0	66
Lane Group Flow (vph)	168	24	0	16	33	25	5	815	3	54	1511	97
Turn Type	Perm			Perm		Perm	Prot		Perm	Prot		Perm
Protected Phases		4			8		5	2		1		6
Permitted Phases	4			8		8			2			6
Actuated Green, G (s)	8.8	8.8		8.8	8.8	8.8	1.1	32.1	32.1	4.3	35.3	35.3
Effective Green, g (s)	8.8	8.8		8.8	8.8	8.8	1.1	32.1	32.1	4.3	35.3	35.3
Actuated g/C Ratio	0.15	0.15		0.15	0.15	0.15	0.02	0.54	0.54	0.07	0.60	0.60
Clearance Time (s)	5.0	5.0		5.0	5.0	5.0	4.0	5.0	5.0	4.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	204	263		204	277	235	33	1919	858	129	2110	944
v/s Ratio Prot		0.01			0.02		0.00	0.23		c0.03	c0.43	
v/s Ratio Perm	c0.12			0.01		0.02			0.00			0.06
v/c Ratio	0.82	0.09		0.08	0.12	0.11	0.15	0.42	0.00	0.42	0.72	0.10
Uniform Delay, d1	24.4	21.7		21.7	21.8	21.8	28.6	8.1	6.2	26.3	8.4	5.1
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	22.8	0.1		0.2	0.2	0.2	2.1	0.7	0.0	2.2	2.1	0.2
Delay (s)	47.2	21.9		21.9	22.0	22.0	30.7	8.7	6.2	28.4	10.5	5.4
Level of Service	D	C		C	C	C	C	A	A	C	B	A
Approach Delay (s)		43.1			22.0			8.9			10.6	
Approach LOS		D			C			A			B	
Intersection Summary												
HCM Average Control Delay			13.2									HCM Level of Service B
HCM Volume to Capacity ratio			0.74									
Actuated Cycle Length (s)			59.2								14.0	Sum of lost time (s)
Intersection Capacity Utilization			65.1%									ICU Level of Service C
Analysis Period (min)			15									
c Critical Lane Group												

Timings
2: Okolani Dr. & Piilani HWY

Austin, Tsutsumi & Associates, Inc.
7/31/2009

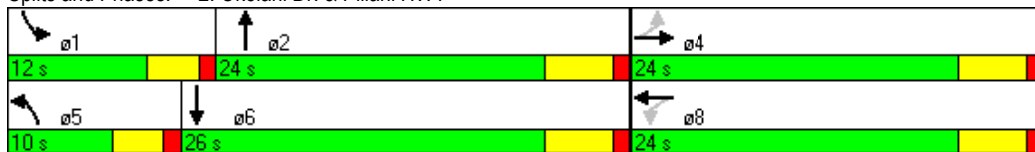


Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations	↶	↷		↶↷	↶	↷	↶	↷
Volume (vph)	185	15	35	20	10	505	35	1205
Turn Type	Perm		Perm		Prot		Prot	
Protected Phases		4		8	5	2	1	6
Permitted Phases	4		8					
Detector Phase	4	4	8	8	5	2	1	6
Switch Phase								
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	24.0	24.0	24.0	24.0	10.0	24.0	10.0	24.0
Total Split (s)	24.0	24.0	24.0	24.0	10.0	24.0	12.0	26.0
Total Split (%)	40.0%	40.0%	40.0%	40.0%	16.7%	40.0%	20.0%	43.3%
Yellow Time (s)	4.0	4.0	4.0	4.0	3.0	4.0	3.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	4.0	5.0	4.0	5.0
Lead/Lag					Lead	Lag	Lead	Lag
Lead-Lag Optimize?								
Recall Mode	None	None	None	None	None	Max	None	Max
Act Effct Green (s)	12.5	12.5		12.5	5.9	23.7	6.6	26.0
Actuated g/C Ratio	0.25	0.25		0.25	0.12	0.47	0.13	0.51
v/c Ratio	0.58	0.10		0.31	0.05	0.34	0.16	0.81
Control Delay	23.6	9.2		9.6	23.4	11.7	22.9	18.2
Queue Delay	0.0	0.0		0.0	0.0	0.0	0.0	0.0
Total Delay	23.6	9.2		9.6	23.4	11.7	22.9	18.2
LOS	C	A		A	C	B	C	B
Approach Delay		21.1		9.6		11.9		18.4
Approach LOS		C		A		B		B

Intersection Summary




















Cycle Length: 60
 Actuated Cycle Length: 50.5
 Natural Cycle: 70
 Control Type: Actuated-Uncoordinated
 Maximum v/c Ratio: 0.81
 Intersection Signal Delay: 16.6
 Intersection LOS: B
 Intersection Capacity Utilization 62.9%
 ICU Level of Service B
 Analysis Period (min) 15

Splits and Phases: 2: Okolani Dr. & Piilani HWY



HCM Signalized Intersection Capacity Analysis
2: Okolani Dr. & Piilani HWY

Austin, Tsutsumi & Associates, Inc.
7/31/2009

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	185	15	25	35	20	70	10	505	15	35	1205	135
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0			5.0		4.0	5.0		4.0	5.0	
Lane Util. Factor	1.00	1.00			1.00		1.00	0.95		1.00	0.95	
Flt	1.00	0.91			0.92		1.00	1.00		1.00	0.98	
Flt Protected	0.95	1.00			0.99		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1687			1698		1770	3524		1770	3486	
Flt Permitted	0.75	1.00			0.91		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1395	1687			1562		1770	3524		1770	3486	
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	16	27	38	22	76	11	549	16	38	1310	147
RTOR Reduction (vph)	0	21	0	0	58	0	0	3	0	0	11	0
Lane Group Flow (vph)	201	22	0	0	78	0	11	562	0	38	1446	0
Turn Type	Perm		Perm				Prot		Prot			
Protected Phases	4		8				5	2	1 6			
Permitted Phases	4		8									
Actuated Green, G (s)	12.5	12.5	12.5				1.0	24.3	2.7 26.0			
Effective Green, g (s)	12.5	12.5	12.5				1.0	24.3	2.7 26.0			
Actuated g/C Ratio	0.23	0.23	0.23				0.02	0.45	0.05 0.49			
Clearance Time (s)	5.0	5.0	5.0				4.0	5.0	4.0 5.0			
Vehicle Extension (s)	3.0	3.0	3.0				3.0	3.0	3.0 3.0			
Lane Grp Cap (vph)	326	394	365				33	1601	89 1694			
v/s Ratio Prot	0.01						0.01	0.16	c0.02 c0.41			
v/s Ratio Perm	c0.14		0.05									
v/c Ratio	0.62	0.06	0.21				0.33	0.35	0.43 0.85			
Uniform Delay, d1	18.4	15.9	16.5				25.9	9.5	24.6 12.1			
Progression Factor	1.00	1.00	1.00				1.00	1.00	1.00 1.00			
Incremental Delay, d2	3.4	0.1	0.3				5.9	0.6	3.3 5.7			
Delay (s)	21.8	16.0	16.8				31.8	10.1	27.9 17.8			
Level of Service	C	B	B				C	B	C B			
Approach Delay (s)	20.8		16.8				10.5		18.0			
Approach LOS	C		B				B		B			
Intersection Summary												
HCM Average Control Delay	16.5		HCM Level of Service				B					
HCM Volume to Capacity ratio	0.70											
Actuated Cycle Length (s)	53.5		Sum of lost time (s)				9.0					
Intersection Capacity Utilization	62.9%		ICU Level of Service				B					
Analysis Period (min)	15											
c Critical Lane Group												

HCM Unsignalized Intersection Capacity Analysis
4: Wailea Ike Dr. & Kalai Waa St

Austin, Tsutsumi & Associates, Inc.
7/31/2009

	→	↘	↙	←	↖	↗	
Movement	EBT	EBR	WBL	WBT	NBL	NBR	
Lane Configurations	↑↑		↘	↑↑	↘	↘	
Volume (veh/h)	430	60	245	1100	50	115	
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)	467	65	266	1196	54	125	
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			533		1630	266	
vC1, stage 1 conf vol							
vC2, stage 2 conf vol							
vCu, unblocked vol			533		1630	266	
tC, single (s)			4.1		6.8	6.9	
tC, 2 stage (s)							
tF (s)			2.2		3.5	3.3	
p0 queue free %			74		21	83	
cM capacity (veh/h)			1031		69	732	
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	WB 3	NB 1	NB 2
Volume Total	312	221	266	598	598	54	125
Volume Left	0	0	266	0	0	54	0
Volume Right	0	65	0	0	0	0	125
cSH	1700	1700	1031	1700	1700	69	732
Volume to Capacity	0.18	0.13	0.26	0.35	0.35	0.79	0.17
Queue Length 95th (ft)	0	0	26	0	0	93	15
Control Delay (s)	0.0	0.0	9.7	0.0	0.0	155.7	10.9
Lane LOS			A			F	B
Approach Delay (s)	0.0		1.8			54.8	
Approach LOS						F	
Intersection Summary							
Average Delay			5.7				
Intersection Capacity Utilization			40.7%	ICU Level of Service	A		
Analysis Period (min)			15				

Timings
7: Wailea Ike Dr. & Wailea Alanui Dr.

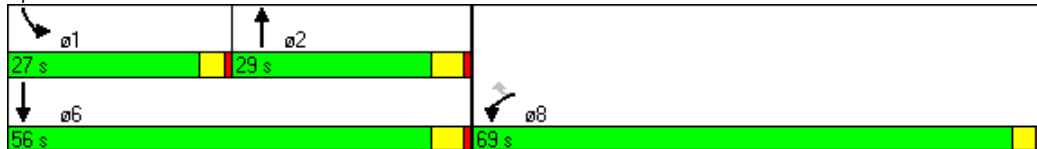
Austin, Tsutsumi & Associates, Inc.
7/31/2009

	↙	↖	↑	↗	↘	↓
Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↙	↖	↑	↗	↘	↕
Volume (vph)	865	200	180	300	175	430
Turn Type	Perm			Free	Prot	
Protected Phases	8		2		1	6
Permitted Phases		8		Free		
Detector Phase	8	8	2		1	6
Switch Phase						
Minimum Initial (s)	4.0	4.0	4.0		4.0	4.0
Minimum Split (s)	22.0	22.0	24.0		10.0	24.0
Total Split (s)	69.0	69.0	29.0	0.0	27.0	56.0
Total Split (%)	55.2%	55.2%	23.2%	0.0%	21.6%	44.8%
Yellow Time (s)	3.0	3.0	4.0		3.0	4.0
All-Red Time (s)	1.0	1.0	1.0		1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	4.0	5.0	4.0	4.0	5.0
Lead/Lag			Lag		Lead	
Lead-Lag Optimize?			Yes		Yes	
Recall Mode	None	None	None		None	None
Act Effct Green (s)	65.4	65.4	17.0	112.4	16.9	37.9
Actuated g/C Ratio	0.58	0.58	0.15	1.00	0.15	0.34
v/c Ratio	0.91	0.22	0.70	0.21	0.71	0.39
Control Delay	37.3	5.1	59.3	0.3	61.3	28.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	37.3	5.1	59.3	0.3	61.3	28.8
LOS	D	A	E	A	E	C
Approach Delay	31.3		22.4			38.2
Approach LOS	C		C			D

Intersection Summary













Cycle Length: 125
 Actuated Cycle Length: 112.4
 Natural Cycle: 90
 Control Type: Actuated-Uncoordinated
 Maximum v/c Ratio: 0.91
 Intersection Signal Delay: 31.3
 Intersection LOS: C
 Intersection Capacity Utilization 77.9%
 ICU Level of Service D
 Analysis Period (min) 15

Splits and Phases: 7: Wailea Ike Dr. & Wailea Alanui Dr.

























HCM Signalized Intersection Capacity Analysis
 7: Wailea Ike Dr. & Wailea Alanui Dr.

Austin, Tsutsumi & Associates, Inc.
 7/31/2009

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	865	200	180	300	175	430
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	5.0	4.0	4.0	5.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	0.95
Flt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1770	1583	1863	1583	1770	3539
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1770	1583	1863	1583	1770	3539
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	940	217	196	326	190	467
RTOR Reduction (vph)	0	63	0	0	0	0
Lane Group Flow (vph)	940	154	196	326	190	467
Turn Type		Perm		Free	Prot	
Protected Phases	8		2		1	6
Permitted Phases		8		Free		
Actuated Green, G (s)	65.4	65.4	17.0	112.3	16.9	37.9
Effective Green, g (s)	65.4	65.4	17.0	112.3	16.9	37.9
Actuated g/C Ratio	0.58	0.58	0.15	1.00	0.15	0.34
Clearance Time (s)	4.0	4.0	5.0		4.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	1031	922	282	1583	266	1194
v/s Ratio Prot	c0.53		c0.11		c0.11	0.13
v/s Ratio Perm		0.10		0.21		
v/c Ratio	0.91	0.17	0.70	0.21	0.71	0.39
Uniform Delay, d1	20.9	10.8	45.2	0.0	45.4	28.4
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	11.9	0.1	7.2	0.3	8.8	0.2
Delay (s)	32.8	10.9	52.4	0.3	54.2	28.6
Level of Service	C	B	D	A	D	C
Approach Delay (s)	28.7		19.9			36.0
Approach LOS	C		B			D
Intersection Summary						
HCM Average Control Delay			28.8		HCM Level of Service	C
HCM Volume to Capacity ratio			0.84			
Actuated Cycle Length (s)			112.3		Sum of lost time (s)	13.0
Intersection Capacity Utilization			77.9%		ICU Level of Service	D
Analysis Period (min)			15			
c Critical Lane Group						











HCM Unsignalized Intersection Capacity Analysis
8: Okolani Dr & Wailea Alanui Dr.

Austin, Tsutsumi & Associates, Inc.
7/31/2009

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control	Stop			Stop			Stop			Stop		
Volume (vph)	10	50	485	105	65	5	220	30	60	10	70	10
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	54	527	114	71	5	239	33	65	11	76	11
Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	NB 1	NB 2	NB 3	SB 1	SB 2		
Volume Total (vph)	11	54	527	185	5	239	33	65	87	11		
Volume Left (vph)	11	0	0	114	0	239	0	0	11	0		
Volume Right (vph)	0	0	527	0	5	0	0	65	0	11		
Hadj (s)	0.53	0.03	-0.67	0.34	-0.67	0.53	0.03	-0.67	0.10	-0.67		
Departure Headway (s)	6.3	5.8	3.2	5.9	4.9	5.9	5.4	3.2	5.7	4.9		
Degree Utilization, x	0.02	0.09	0.47	0.30	0.01	0.39	0.05	0.06	0.14	0.01		
Capacity (veh/h)	532	578	1116	579	683	592	638	1121	604	689		
Control Delay (s)	8.2	8.2	7.8	10.3	6.8	11.4	7.5	5.2	8.3	6.8		
Approach Delay (s)	7.8			10.2			9.8			8.2		
Approach LOS	A			B			A			A		
Intersection Summary												
Delay			8.8									
HCM Level of Service			A									
Intersection Capacity Utilization			53.5%		ICU Level of Service						A	
Analysis Period (min)			15									

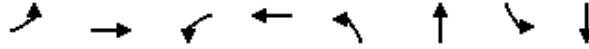
HCM Unsignalized Intersection Capacity Analysis
 9: Kilohana Dr & South Kihei Rd

Austin, Tsutsumi & Associates, Inc.
 7/31/2009

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	10	95	270	10	95	520
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	11	103	293	11	103	565
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)		1				
Median type			None			None
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1071	299			304	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1071	299			304	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	95	86			92	
cM capacity (veh/h)	224	741			1256	
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	114	304	668			
Volume Left	11	0	103			
Volume Right	103	11	0			
cSH	819	1700	1256			
Volume to Capacity	0.14	0.18	0.08			
Queue Length 95th (ft)	12	0	7			
Control Delay (s)	11.7	0.0	2.1			
Lane LOS	B		A			
Approach Delay (s)	11.7	0.0	2.1			
Approach LOS	B					
Intersection Summary						
Average Delay		2.5				
Intersection Capacity Utilization		60.8%		ICU Level of Service		B
Analysis Period (min)		15				

Timings
10: Grand Wailea Resort & Wailea Alanui Dr.

Austin, Tsutsumi & Associates, Inc.
7/31/2009

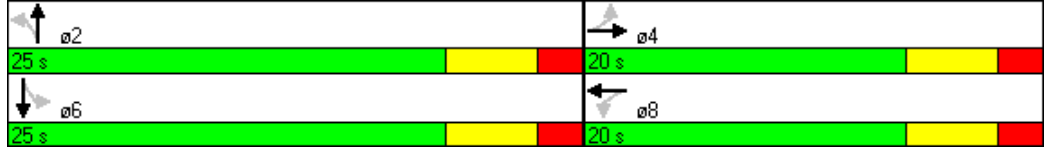


Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations		↕		↕	↖	↗	↖	↗
Volume (vph)	35	5	10	5	20	350	180	845
Turn Type	Perm		Perm		Perm		Perm	
Protected Phases		4		8		2		6
Permitted Phases	4		8		2		6	
Detector Phase	4	4	8	8	2	2	6	6
Switch Phase								
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	20.0	20.0	20.0	24.0	24.0	24.0	24.0
Total Split (s)	20.0	20.0	20.0	20.0	25.0	25.0	25.0	25.0
Total Split (%)	44.4%	44.4%	44.4%	44.4%	55.6%	55.6%	55.6%	55.6%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode	None	None	None	None	Min	Min	Min	Min
Act Effct Green (s)		6.7		6.6	27.8	27.8	27.8	27.8
Actuated g/C Ratio		0.19		0.19	0.79	0.79	0.79	0.79
v/c Ratio		0.16		0.21	0.05	0.15	0.26	0.37
Control Delay		11.3		7.9	5.4	3.5	6.0	4.5
Queue Delay		0.0		0.0	0.0	0.0	0.0	0.0
Total Delay		11.3		7.9	5.4	3.5	6.0	4.5
LOS		B		A	A	A	A	A
Approach Delay		11.3		7.9		3.6		4.7
Approach LOS		B		A		A		A

Intersection Summary



















Cycle Length: 45
 Actuated Cycle Length: 35
 Natural Cycle: 45
 Control Type: Actuated-Uncoordinated
 Maximum v/c Ratio: 0.37
 Intersection Signal Delay: 4.8
 Intersection LOS: A
 Intersection Capacity Utilization 54.5%
 ICU Level of Service A
 Analysis Period (min) 15

Splits and Phases: 10: Grand Wailea Resort & Wailea Alanui Dr.
























HCM Signalized Intersection Capacity Analysis
 10: Grand Wailea Resort & Wailea Alanui Dr.

Austin, Tsutsumi & Associates, Inc.
 7/31/2009

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	35	5	15	10	5	50	20	350	25	180	845	100
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.0			6.0		6.0	6.0		6.0	6.0	
Lane Util. Factor		1.00			1.00		1.00	0.95		1.00	0.95	
Flt Protected		0.96			0.90		1.00	0.99		1.00	0.98	
Flt Permitted		0.97			0.99		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1739			1656		1770	3504		1770	3483	
Satd. Flow (perm)		1795			1555		511	3504		955	3483	
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)	38	5	16	11	5	54	22	380	27	196	918	109
RTOR Reduction (vph)	0	15	0	0	50	0	0	8	0	0	13	0
Lane Group Flow (vph)	0	44	0	0	20	0	22	399	0	196	1014	0
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)		2.9			2.9		23.9	23.9		23.9	23.9	
Effective Green, g (s)		2.9			2.9		23.9	23.9		23.9	23.9	
Actuated g/C Ratio		0.07			0.07		0.62	0.62		0.62	0.62	
Clearance Time (s)		6.0			6.0		6.0	6.0		6.0	6.0	
Vehicle Extension (s)		3.0			3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		134			116		315	2158		588	2145	
v/s Ratio Prot								0.11			c0.29	
v/s Ratio Perm		c0.02			0.01		0.04			0.21		
v/c Ratio		0.33			0.17		0.07	0.19		0.33	0.47	
Uniform Delay, d1		17.0			16.8		3.0	3.2		3.6	4.0	
Progression Factor		1.00			1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2		1.4			0.7		0.1	0.0		0.3	0.2	
Delay (s)		18.5			17.5		3.1	3.3		3.9	4.2	
Level of Service		B			B		A	A		A	A	
Approach Delay (s)		18.5			17.5			3.3			4.2	
Approach LOS		B			B			A			A	
Intersection Summary												
HCM Average Control Delay			4.9				HCM Level of Service			A		
HCM Volume to Capacity ratio			0.46									
Actuated Cycle Length (s)			38.8				Sum of lost time (s)		12.0			
Intersection Capacity Utilization			54.5%				ICU Level of Service		A			
Analysis Period (min)			15									
c Critical Lane Group												

HCM Unsignalized Intersection Capacity Analysis
 11: Kaukahi Dr & Wailea Alanui Dr.

Austin, Tsutsumi & Associates, Inc.
 9/22/2009

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	30	20	5	50	30	35	5	230	25	20	445	140
Sign Control		Stop			Stop			Free			Free	
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)	33	22	5	54	33	38	5	250	27	22	484	152
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	804	788	484	804	940	250	636			250		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	804	788	484	804	940	250	636			250		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	87	93	99	80	87	95	99			98		
cM capacity (veh/h)	254	316	583	278	258	789	948			1316		
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2	SB 1	SB 2	SB 3			
Volume Total	33	27	54	71	255	27	22	484	152			
Volume Left	33	0	54	0	5	0	22	0	0			
Volume Right	0	5	0	38	0	27	0	0	152			
cSH	254	348	278	404	948	1700	1316	1700	1700			
Volume to Capacity	0.13	0.08	0.20	0.17	0.01	0.02	0.02	0.28	0.09			
Queue Length 95th (ft)	11	6	18	16	0	0	1	0	0			
Control Delay (s)	21.2	16.2	21.1	15.8	0.2	0.0	7.8	0.0	0.0			
Lane LOS	C	C	C	C	A		A					
Approach Delay (s)	18.9		18.1		0.2		0.3					
Approach LOS	C		C									
Intersection Summary												
Average Delay			3.2									
Intersection Capacity Utilization			40.1%		ICU Level of Service				A			
Analysis Period (min)			15									

Timings
1: Kilohana Dr & Piilani HWY

Austin, Tsutsumi & Associates, Inc.
1/13/2010

	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	175	35	10	30	140	20	1510	15	160	1190	230
Turn Type	Perm		Perm		Perm	Prot		Perm	Prot		Perm
Protected Phases		4		8		5	2		1	6	
Permitted Phases	4		8		8			2			6
Detector Phase	4	4	8	8	8	5	2	2	1	6	6
Switch Phase											
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	12.0	12.0	12.0	12.0	12.0	10.0	24.0	24.0	10.0	24.0	24.0
Total Split (s)	35.0	35.0	35.0	35.0	35.0	10.0	62.0	62.0	23.0	75.0	75.0
Total Split (%)	29.2%	29.2%	29.2%	29.2%	29.2%	8.3%	51.7%	51.7%	19.2%	62.5%	62.5%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	3.0	4.0	4.0	3.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	4.0	5.0	5.0	4.0	5.0	5.0
Lead/Lag						Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?											
Recall Mode	None	None	None	None	None	Min	Max	Max	Min	None	None

Intersection Summary

Cycle Length: 120
 Actuated Cycle Length: 106.6
 Natural Cycle: 70
 Control Type: Actuated-Uncoordinated

Splits and Phases: 1: Kilohana Dr & Piilani HWY



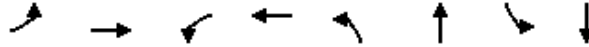
HCM Signalized Intersection Capacity Analysis
1: Kilohana Dr & Piilani HWY

Austin, Tsutsumi & Associates, Inc.
1/13/2010

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗		↖	↗	↗	↖	↕	↗	↖	↕	↗
Volume (vph)	175	35	10	10	30	140	20	1510	15	160	1190	230
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0	5.0	4.0	5.0	5.0	4.0	5.0	5.0
Lane Util. Factor	1.00	1.00		1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Flt Protected	1.00	0.97		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	1800		1770	1863	1583	1770	3539	1583	1770	3539	1583
Satd. Flow (perm)	1370	1800		1351	1863	1583	1770	3539	1583	1770	3539	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)	190	38	11	11	33	152	22	1641	16	174	1293	250
RTOR Reduction (vph)	0	9	0	0	0	123	0	0	6	0	0	94
Lane Group Flow (vph)	190	40	0	11	33	29	22	1641	10	174	1293	156
Turn Type	Perm			Perm		Perm	Prot		Perm	Prot		Perm
Protected Phases	4			8		8	5	2		1	6	
Permitted Phases	4			8		8			2			6
Actuated Green, G (s)	20.0	20.0		20.0	20.0	20.0	5.9	57.5	57.5	15.0	66.6	66.6
Effective Green, g (s)	20.0	20.0		20.0	20.0	20.0	5.9	57.5	57.5	15.0	66.6	66.6
Actuated g/C Ratio	0.19	0.19		0.19	0.19	0.19	0.06	0.54	0.54	0.14	0.63	0.63
Clearance Time (s)	5.0	5.0		5.0	5.0	5.0	4.0	5.0	5.0	4.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	257	338		254	350	297	98	1911	855	249	2213	990
v/s Ratio Prot		0.02			0.02		0.01	c0.46		c0.10	0.37	
v/s Ratio Perm	c0.14			0.01		0.02			0.01			0.10
v/c Ratio	0.74	0.12		0.04	0.09	0.10	0.22	0.86	0.01	0.70	0.58	0.16
Uniform Delay, d1	40.8	35.9		35.4	35.8	35.8	48.1	21.0	11.3	43.6	11.8	8.3
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	10.6	0.2		0.1	0.1	0.1	1.2	5.3	0.0	8.3	0.4	0.1
Delay (s)	51.4	36.1		35.5	35.9	35.9	49.3	26.3	11.4	51.9	12.2	8.4
Level of Service	D	D		D	D	D	D	C	B	D	B	A
Approach Delay (s)	48.3			35.9			26.5			15.6		
Approach LOS	D			D			C			B		
Intersection Summary												
HCM Average Control Delay			23.5			HCM Level of Service		C				
HCM Volume to Capacity ratio			0.81									
Actuated Cycle Length (s)			106.5			Sum of lost time (s)		14.0				
Intersection Capacity Utilization			78.6%			ICU Level of Service		D				
Analysis Period (min)			15									
c Critical Lane Group												

Timings
2: Okolani Dr. & Piilani HWY

Austin, Tsutsumi & Associates, Inc.
7/31/2009



Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations	↖	↗		↕	↖	↗	↖	↗
Volume (vph)	250	35	15	20	40	1190	80	835
Turn Type	Perm		Perm		Prot		Prot	
Protected Phases		4		8	5	2	1	6
Permitted Phases	4		8					
Detector Phase	4	4	8	8	5	2	1	6
Switch Phase								
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	24.0	24.0	24.0	24.0	10.0	24.0	10.0	24.0
Total Split (s)	27.0	27.0	27.0	27.0	12.0	39.0	14.0	41.0
Total Split (%)	33.8%	33.8%	33.8%	33.8%	15.0%	48.8%	17.5%	51.3%
Yellow Time (s)	4.0	4.0	4.0	4.0	3.0	4.0	3.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	4.0	5.0	4.0	5.0
Lead/Lag					Lead	Lag	Lead	Lag
Lead-Lag Optimize?								
Recall Mode	None	None	None	None	None	Max	None	Max
Act Effct Green (s)	18.2	18.2		18.2	7.0	36.0	8.4	39.5
Actuated g/C Ratio	0.24	0.24		0.24	0.09	0.48	0.11	0.53
v/c Ratio	0.78	0.16		0.21	0.26	0.78	0.43	0.65
Control Delay	43.7	14.6		12.6	37.2	22.6	39.4	16.0
Queue Delay	0.0	0.0		0.0	0.0	0.0	0.0	0.0
Total Delay	43.7	14.6		12.6	37.2	22.6	39.4	16.0
LOS	D	B		B	D	C	D	B
Approach Delay		37.7		12.6		23.1		17.5
Approach LOS		D		B		C		B

Intersection Summary




















Cycle Length: 80
 Actuated Cycle Length: 74.4
 Natural Cycle: 65
 Control Type: Actuated-Uncoordinated
 Maximum v/c Ratio: 0.78
 Intersection Signal Delay: 22.1
 Intersection LOS: C
 Intersection Capacity Utilization 70.8%
 ICU Level of Service C
 Analysis Period (min) 15

Splits and Phases: 2: Okolani Dr. & Piilani HWY



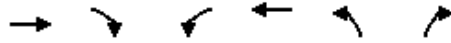
HCM Signalized Intersection Capacity Analysis
2: Okolani Dr. & Piilani HWY

Austin, Tsutsumi & Associates, Inc.
7/31/2009

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	250	35	30	15	20	50	40	1190	40	80	835	270
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0			5.0		4.0	5.0		4.0	5.0	
Lane Util. Factor	1.00	1.00			1.00		1.00	0.95		1.00	0.95	
Flt Protected	1.00	0.93			0.92		1.00	1.00		1.00	0.96	
Flt Permitted	0.95	1.00			0.99		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1733			1700		1770	3522		1770	3410	
Satd. Flow (perm)	1415	1733			1632		1770	3522		1770	3410	
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)	272	38	33	16	22	54	43	1293	43	87	908	293
RTOR Reduction (vph)	0	25	0	0	41	0	0	3	0	0	34	0
Lane Group Flow (vph)	272	46	0	0	51	0	43	1333	0	87	1167	0
Turn Type	Perm			Perm			Prot			Prot		
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8								
Actuated Green, G (s)	18.2	18.2			18.2		4.4	36.8		7.0	39.4	
Effective Green, g (s)	18.2	18.2			18.2		4.4	36.8		7.0	39.4	
Actuated g/C Ratio	0.24	0.24			0.24		0.06	0.48		0.09	0.52	
Clearance Time (s)	5.0	5.0			5.0		4.0	5.0		4.0	5.0	
Vehicle Extension (s)	3.0	3.0			3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	339	415			391		102	1705		163	1768	
v/s Ratio Prot		0.03					0.02	c0.38		c0.05	c0.34	
v/s Ratio Perm	c0.19			0.03								
v/c Ratio	0.80	0.11		0.13			0.42	0.78		0.53	0.66	
Uniform Delay, d1	27.2	22.6		22.7			34.6	16.3		32.9	13.4	
Progression Factor	1.00	1.00		1.00			1.00	1.00		1.00	1.00	
Incremental Delay, d2	12.8	0.1		0.2			2.8	3.7		3.3	2.0	
Delay (s)	40.0	22.7		22.8			37.4	19.9		36.3	15.3	
Level of Service	D	C		C			D	B		D	B	
Approach Delay (s)		36.4		22.8				20.5			16.8	
Approach LOS		D		C				C			B	
Intersection Summary												
HCM Average Control Delay			20.8				HCM Level of Service			C		
HCM Volume to Capacity ratio			0.82									
Actuated Cycle Length (s)			76.0				Sum of lost time (s)		19.0			
Intersection Capacity Utilization			70.8%				ICU Level of Service		C			
Analysis Period (min)			15									
c Critical Lane Group												

HCM Unsignalized Intersection Capacity Analysis
 4: Wailea Ike Dr. & Kalai Waa St

Austin, Tsutsumi & Associates, Inc.
 7/31/2009



Movement	EBT	EBR	WBL	WBT	NBL	NBR	
Lane Configurations	↑↑		↵	↑↑	↵	↵	
Volume (veh/h)	1065	90	155	740	100	275	
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)	1158	98	168	804	109	299	
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			1255		1946	628	
vC1, stage 1 conf vol							
vC2, stage 2 conf vol							
vCu, unblocked vol			1255		1946	628	
tC, single (s)			4.1		6.8	6.9	
tC, 2 stage (s)							
tF (s)			2.2		3.5	3.3	
p0 queue free %			69		0	30	
cM capacity (veh/h)			550		39	426	
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	WB 3	NB 1	NB 2
Volume Total	772	484	168	402	402	109	299
Volume Left	0	0	168	0	0	109	0
Volume Right	0	98	0	0	0	0	299
cSH	1700	1700	550	1700	1700	39	426
Volume to Capacity	0.45	0.28	0.31	0.24	0.24	2.76	0.70
Queue Length 95th (ft)	0	0	32	0	0	301	132
Control Delay (s)	0.0	0.0	14.4	0.0	0.0	1013.7	31.0
Lane LOS			B			F	D
Approach Delay (s)	0.0		2.5		293.1		
Approach LOS					F		
Intersection Summary							
Average Delay			46.2				
Intersection Capacity Utilization			56.4%		ICU Level of Service		B
Analysis Period (min)			15				

Timings
7: Wailea Ike Dr. & Wailea Alanui Dr.

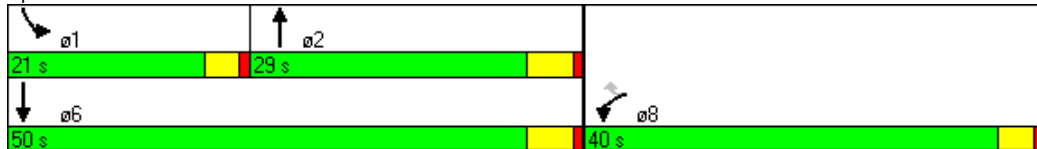
Austin, Tsutsumi & Associates, Inc.
7/31/2009

	↙	↖	↑	↗	↘	↓
Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↙	↖	↑	↗	↘	↕
Volume (vph)	515	265	410	775	260	380
Turn Type	Perm			Free	Prot	
Protected Phases	8		2		1	6
Permitted Phases		8		Free		
Detector Phase	8	8	2		1	6
Switch Phase						
Minimum Initial (s)	4.0	4.0	4.0		4.0	4.0
Minimum Split (s)	22.0	22.0	24.0		10.0	24.0
Total Split (s)	40.0	40.0	29.0	0.0	21.0	50.0
Total Split (%)	44.4%	44.4%	32.2%	0.0%	23.3%	55.6%
Yellow Time (s)	3.0	3.0	4.0		3.0	4.0
All-Red Time (s)	1.0	1.0	1.0		1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	4.0	5.0	4.0	4.0	5.0
Lead/Lag			Lag		Lead	
Lead-Lag Optimize?			Yes		Yes	
Recall Mode	None	None	None		None	None
Act Effct Green (s)	30.0	30.0	22.5	81.8	16.1	42.6
Actuated g/C Ratio	0.37	0.37	0.28	1.00	0.20	0.52
v/c Ratio	0.86	0.38	0.87	0.53	0.81	0.22
Control Delay	39.2	3.9	49.5	1.3	53.4	11.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	39.2	3.9	49.5	1.3	53.4	11.8
LOS	D	A	D	A	D	B
Approach Delay	27.2		18.0			28.7
Approach LOS	C		B			C

Intersection Summary







Cycle Length: 90
 Actuated Cycle Length: 81.8
 Natural Cycle: 75
 Control Type: Actuated-Uncoordinated
 Maximum v/c Ratio: 0.87
 Intersection Signal Delay: 23.4
 Intersection LOS: C
 Intersection Capacity Utilization 75.3%
 ICU Level of Service D
 Analysis Period (min) 15

Splits and Phases: 7: Wailea Ike Dr. & Wailea Alanui Dr.

























HCM Signalized Intersection Capacity Analysis
 7: Wailea Ike Dr. & Wailea Alanui Dr.

Austin, Tsutsumi & Associates, Inc.
 7/31/2009

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↶	↶	↑	↷	↷	⇓
Volume (vph)	515	265	410	775	260	380
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	5.0	4.0	4.0	5.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	0.95
Flt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1770	1583	1863	1583	1770	3539
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1770	1583	1863	1583	1770	3539
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	560	288	446	842	283	413
RTOR Reduction (vph)	0	182	0	0	0	0
Lane Group Flow (vph)	560	106	446	842	283	413
Turn Type		Perm		Free	Prot	
Protected Phases	8		2		1	6
Permitted Phases		8		Free		
Actuated Green, G (s)	30.0	30.0	22.5	81.6	16.1	42.6
Effective Green, g (s)	30.0	30.0	22.5	81.6	16.1	42.6
Actuated g/C Ratio	0.37	0.37	0.28	1.00	0.20	0.52
Clearance Time (s)	4.0	4.0	5.0		4.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	651	582	514	1583	349	1848
v/s Ratio Prot	c0.32		c0.24		c0.16	0.12
v/s Ratio Perm		0.07		0.53		
v/c Ratio	0.86	0.18	0.87	0.53	0.81	0.22
Uniform Delay, d1	23.9	17.5	28.1	0.0	31.3	10.6
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	11.2	0.2	14.4	1.3	13.3	0.1
Delay (s)	35.1	17.6	42.5	1.3	44.6	10.6
Level of Service	D	B	D	A	D	B
Approach Delay (s)	29.1		15.6			24.4
Approach LOS	C		B			C
Intersection Summary						
HCM Average Control Delay			21.8		HCM Level of Service	C
HCM Volume to Capacity ratio			0.85			
Actuated Cycle Length (s)			81.6		Sum of lost time (s)	13.0
Intersection Capacity Utilization			75.3%		ICU Level of Service	D
Analysis Period (min)			15			
c Critical Lane Group						











HCM Unsignalized Intersection Capacity Analysis
 8: Okolani Dr & Wailea Alanui Dr.

Austin, Tsutsumi & Associates, Inc.
 7/31/2009

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control	Stop			Stop			Stop			Stop		
Volume (vph)	15	90	435	95	70	15	485	105	145	15	35	15
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)	16	98	473	103	76	16	527	114	158	16	38	16
Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	NB 1	NB 2	NB 3	SB 1	SB 2		
Volume Total (vph)	16	98	473	179	16	527	114	158	54	16		
Volume Left (vph)	16	0	0	103	0	527	0	0	16	0		
Volume Right (vph)	0	0	473	0	16	0	0	158	0	16		
Hadj (s)	0.53	0.03	-0.67	0.32	-0.67	0.53	0.03	-0.67	0.18	-0.67		
Departure Headway (s)	7.4	6.9	3.2	7.0	6.0	6.2	5.7	3.2	6.6	5.7		
Degree Utilization, x	0.03	0.19	0.42	0.35	0.03	0.90	0.18	0.14	0.10	0.03		
Capacity (veh/h)	463	498	1115	495	567	571	619	1121	517	587		
Control Delay (s)	9.4	10.2	7.3	12.5	8.0	40.4	8.7	5.5	9.1	7.7		
Approach Delay (s)	7.8				12.1	29.0			8.8			
Approach LOS	A			B			D			A		
Intersection Summary												
Delay			18.6									
HCM Level of Service			C									
Intersection Capacity Utilization			55.8%		ICU Level of Service				B			
Analysis Period (min)			15									

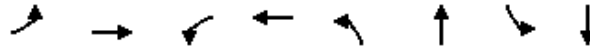
HCM Unsignalized Intersection Capacity Analysis
 9: Kilohana Dr & South Kihei Rd

Austin, Tsutsumi & Associates, Inc.
 7/31/2009

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	35	155	545	25	100	515
Sign Control	Stop		Free		Free	
Grade	0%		0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	38	168	592	27	109	560
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)	1					
Median type			None		None	
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1383	606			620	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1383	606			620	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	73	66			89	
cM capacity (veh/h)	140	497			961	
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	207	620	668			
Volume Left	38	0	109			
Volume Right	168	27	0			
cSH	609	1700	961			
Volume to Capacity	0.34	0.36	0.11			
Queue Length 95th (ft)	37	0	10			
Control Delay (s)	20.3	0.0	2.8			
Lane LOS	C		A			
Approach Delay (s)	20.3	0.0	2.8			
Approach LOS	C					
Intersection Summary						
Average Delay			4.1			
Intersection Capacity Utilization			76.2%	ICU Level of Service	D	
Analysis Period (min)			15			

Timings
10: Grand Wailea Resort & Wailea Alanui Dr.

Austin, Tsutsumi & Associates, Inc.
7/31/2009

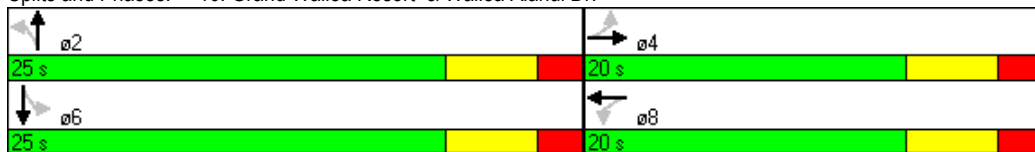


Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations		↕		↕	↖	↗	↖	↗
Volume (vph)	105	5	10	15	30	900	60	585
Turn Type	Perm		Perm		Perm		Perm	
Protected Phases		4		8		2		6
Permitted Phases	4		8		2		6	
Detector Phase	4	4	8	8	2	2	6	6
Switch Phase								
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	20.0	20.0	20.0	24.0	24.0	24.0	24.0
Total Split (s)	20.0	20.0	20.0	20.0	25.0	25.0	25.0	25.0
Total Split (%)	44.4%	44.4%	44.4%	44.4%	55.6%	55.6%	55.6%	55.6%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode	None	None	None	None	Min	Min	Min	Min
Act Effct Green (s)		9.2		9.2	22.6	22.6	22.6	22.6
Actuated g/C Ratio		0.23		0.23	0.57	0.57	0.57	0.57
v/c Ratio		0.45		0.19	0.08	0.49	0.23	0.35
Control Delay		15.9		7.5	7.9	8.8	10.8	7.4
Queue Delay		0.0		0.0	0.0	0.0	0.0	0.0
Total Delay		15.9		7.5	7.9	8.8	10.8	7.4
LOS		B		A	A	A	B	A
Approach Delay		15.9		7.5		8.8		7.7
Approach LOS		B		A		A		A

Intersection Summary



















Cycle Length: 45
 Actuated Cycle Length: 39.4
 Natural Cycle: 45
 Control Type: Actuated-Uncoordinated
 Maximum v/c Ratio: 0.49
 Intersection Signal Delay: 8.8
 Intersection LOS: A
 Intersection Capacity Utilization 57.8%
 ICU Level of Service B
 Analysis Period (min) 15

Splits and Phases: 10: Grand Wailea Resort & Wailea Alanui Dr.



HCM Signalized Intersection Capacity Analysis
 10: Grand Wailea Resort & Wailea Alanui Dr.

Austin, Tsutsumi & Associates, Inc.
 7/31/2009

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	105	5	25	10	15	45	30	900	10	60	585	65
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.0			6.0		6.0	6.0		6.0	6.0	
Lane Util. Factor		1.00			1.00		1.00	0.95		1.00	0.95	
Flt Protected		0.98			0.91		1.00	1.00		1.00	0.98	
Flt Permitted		0.96			0.99		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1748			1688		1770	3533		1770	3486	
Satd. Flow (perm)		1313			1565		713	3533		488	3486	
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)	114	5	27	11	16	49	33	978	11	65	636	71
RTOR Reduction (vph)	0	21	0	0	40	0	0	1	0	0	16	0
Lane Group Flow (vph)	0	125	0	0	36	0	33	988	0	65	691	0
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)		7.7			7.7		21.0	21.0		21.0	21.0	
Effective Green, g (s)		7.7			7.7		21.0	21.0		21.0	21.0	
Actuated g/C Ratio		0.19			0.19		0.52	0.52		0.52	0.52	
Clearance Time (s)		6.0			6.0		6.0	6.0		6.0	6.0	
Vehicle Extension (s)		3.0			3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		248			296		368	1823		252	1799	
v/s Ratio Prot								c0.28			0.20	
v/s Ratio Perm		c0.10			0.02		0.05			0.13		
v/c Ratio		0.50			0.12		0.09	0.54		0.26	0.38	
Uniform Delay, d1		14.8			13.7		5.0	6.6		5.5	5.9	
Progression Factor		1.00			1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2		1.6			0.2		0.1	0.3		0.5	0.1	
Delay (s)		16.4			13.9		5.1	6.9		6.0	6.1	
Level of Service		B			B		A	A		A	A	
Approach Delay (s)		16.4			13.9			6.9			6.1	
Approach LOS		B			B			A			A	
Intersection Summary												
HCM Average Control Delay			7.5				HCM Level of Service			A		
HCM Volume to Capacity ratio			0.53									
Actuated Cycle Length (s)			40.7				Sum of lost time (s)		12.0			
Intersection Capacity Utilization			57.8%				ICU Level of Service		B			
Analysis Period (min)			15									
c Critical Lane Group												

HCM Unsignalized Intersection Capacity Analysis
 11: Kaukahi Dr & Wailea Alanui Dr.

Austin, Tsutsumi & Associates, Inc.
 9/22/2009

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	95	25	10	45	15	5	10	565	50	35	450	65
Sign Control		Stop			Stop			Free			Free	
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)	103	27	11	49	16	5	11	614	54	38	489	71
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	1209	1201	489	1226	1272	614	560			614		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1209	1201	489	1226	1272	614	560			614		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	26	85	98	62	90	99	99			96		
cM capacity (veh/h)	140	176	579	129	159	492	1011			965		
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2	SB 1	SB 2	SB 3			
Volume Total	103	38	49	22	625	54	38	489	71			
Volume Left	103	0	49	0	11	0	38	0	0			
Volume Right	0	11	0	5	0	54	0	0	71			
cSH	140	219	129	192	1011	1700	965	1700	1700			
Volume to Capacity	0.74	0.17	0.38	0.11	0.01	0.03	0.04	0.29	0.04			
Queue Length 95th (ft)	108	15	39	9	1	0	3	0	0			
Control Delay (s)	81.3	24.8	48.8	26.2	0.3	0.0	8.9	0.0	0.0			
Lane LOS	F	C	E	D	A		A					
Approach Delay (s)	66.1		41.8		0.3		0.6					
Approach LOS	F		E									
Intersection Summary												
Average Delay			8.6									
Intersection Capacity Utilization			56.3%		ICU Level of Service					B		
Analysis Period (min)			15									



APPENDIX C

LEVEL OF SERVICE CALCULATIONS

- Base Year 2022 WITHOUT Project
-

Timings
1: Kilohana Dr & Piilani HWY

Austin, Tsutsumi & Associates, Inc.
1/13/2010

	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	160	20	15	30	160	5	800	5	50	1465	155
Turn Type	Perm		Perm		Perm	Prot		Perm	Prot		Perm
Protected Phases		4		8		5	2		1	6	
Permitted Phases	4		8		8			2			6
Detector Phase	4	4	8	8	8	5	2	2	1	6	6
Switch Phase											
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	12.0	12.0	12.0	12.0	12.0	10.0	24.0	24.0	10.0	24.0	24.0
Total Split (s)	17.0	17.0	17.0	17.0	17.0	10.0	31.0	31.0	12.0	33.0	33.0
Total Split (%)	28.3%	28.3%	28.3%	28.3%	28.3%	16.7%	51.7%	51.7%	20.0%	55.0%	55.0%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	3.0	4.0	4.0	3.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	4.0	5.0	5.0	4.0	5.0	5.0
Lead/Lag						Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?											
Recall Mode	None	None	None	None	None	None	Max	Max	None	Max	Max

Intersection Summary
























Cycle Length: 60
 Actuated Cycle Length: 57.5
 Natural Cycle: 60
 Control Type: Actuated-Uncoordinated

Splits and Phases: 1: Kilohana Dr & Piilani HWY



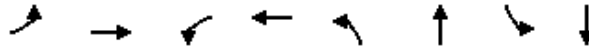
HCM Signalized Intersection Capacity Analysis
1: Kilohana Dr & Piilani HWY

Austin, Tsutsumi & Associates, Inc.
1/13/2010

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations													
Volume (vph)	160	20	10	15	30	160	5	800	5	50	1465	155	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)	5.0	5.0		5.0	5.0	5.0	4.0	5.0	5.0	4.0	5.0	5.0	
Lane Util. Factor	1.00	1.00		1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Flt Protected	1.00	0.95		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1770	1770		1770	1863	1583	1770	3539	1583	1770	3539	1583	
Satd. Flow (perm)	1370	1770		1370	1863	1583	1770	3539	1583	1770	3539	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)	174	22	11	16	33	174	5	870	5	54	1592	168	
RTOR Reduction (vph)	0	9	0	0	0	143	0	0	2	0	0	72	
Lane Group Flow (vph)	174	24	0	16	33	31	5	870	3	54	1592	96	
Turn Type	Perm			Perm		Perm	Prot		Perm	Prot		Perm	
Protected Phases		4			8		5	2		1	6		
Permitted Phases	4			8		8			2			6	
Actuated Green, G (s)	10.7	10.7		10.7	10.7	10.7	1.2	31.5	31.5	4.5	34.8	34.8	
Effective Green, g (s)	10.7	10.7		10.7	10.7	10.7	1.2	31.5	31.5	4.5	34.8	34.8	
Actuated g/C Ratio	0.18	0.18		0.18	0.18	0.18	0.02	0.52	0.52	0.07	0.57	0.57	
Clearance Time (s)	5.0	5.0		5.0	5.0	5.0	4.0	5.0	5.0	4.0	5.0	5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	241	312		241	328	279	35	1837	821	131	2029	908	
v/s Ratio Prot		0.01			0.02		0.00	0.25		c0.03	c0.45		
v/s Ratio Perm	c0.13			0.01		0.02			0.00			0.06	
v/c Ratio	0.72	0.08		0.07	0.10	0.11	0.14	0.47	0.00	0.41	0.78	0.11	
Uniform Delay, d1	23.6	20.9		20.8	21.0	21.0	29.2	9.3	7.0	26.8	10.0	5.9	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	10.2	0.1		0.1	0.1	0.2	1.9	0.9	0.0	2.1	3.1	0.2	
Delay (s)	33.8	21.0		21.0	21.1	21.2	31.1	10.2	7.0	28.9	13.2	6.1	
Level of Service	C	C		C	C	C	C	B	A	C	B	A	
Approach Delay (s)		31.7			21.1			10.3			13.0		
Approach LOS		C			C			B			B		
Intersection Summary													
HCM Average Control Delay			14.1									HCM Level of Service	B
HCM Volume to Capacity ratio			0.77										
Actuated Cycle Length (s)			60.7									Sum of lost time (s)	14.0
Intersection Capacity Utilization			65.4%									ICU Level of Service	C
Analysis Period (min)			15										
c Critical Lane Group													

Timings
2: Okolani Dr. & Piilani HWY

Austin, Tsutsumi & Associates, Inc.
7/31/2009

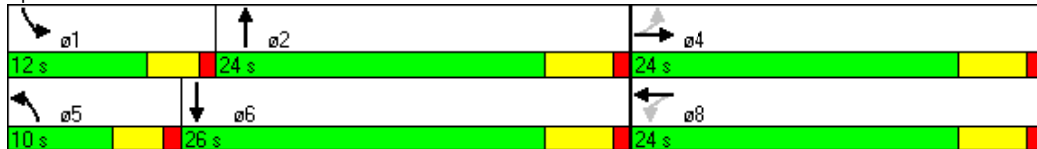


Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations	↖	↗		↕	↖	↗	↖	↗
Volume (vph)	185	15	40	25	10	550	35	1275
Turn Type	Perm		Perm		Prot		Prot	
Protected Phases		4		8	5	2	1	6
Permitted Phases	4		8					
Detector Phase	4	4	8	8	5	2	1	6
Switch Phase								
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	24.0	24.0	24.0	24.0	10.0	24.0	10.0	24.0
Total Split (s)	24.0	24.0	24.0	24.0	10.0	24.0	12.0	26.0
Total Split (%)	40.0%	40.0%	40.0%	40.0%	16.7%	40.0%	20.0%	43.3%
Yellow Time (s)	4.0	4.0	4.0	4.0	3.0	4.0	3.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	4.0	5.0	4.0	5.0
Lead/Lag					Lead	Lag	Lead	Lag
Lead-Lag Optimize?								
Recall Mode	None	None	None	None	None	Max	None	Max
Act Effct Green (s)	12.6	12.6		12.6	5.9	23.7	6.6	26.1
Actuated g/C Ratio	0.25	0.25		0.25	0.12	0.47	0.13	0.52
v/c Ratio	0.59	0.10		0.33	0.05	0.37	0.16	0.85
Control Delay	24.3	9.2		10.2	23.5	12.0	23.0	20.2
Queue Delay	0.0	0.0		0.0	0.0	0.0	0.0	0.0
Total Delay	24.3	9.2		10.2	23.5	12.0	23.0	20.2
LOS	C	A		B	C	B	C	C
Approach Delay		21.6		10.2		12.2		20.3
Approach LOS		C		B		B		C

Intersection Summary





















Cycle Length: 60
 Actuated Cycle Length: 50.6
 Natural Cycle: 70
 Control Type: Actuated-Uncoordinated
 Maximum v/c Ratio: 0.85
 Intersection Signal Delay: 17.9
 Intersection LOS: B
 Intersection Capacity Utilization 65.0%
 ICU Level of Service C
 Analysis Period (min) 15

Splits and Phases: 2: Okolani Dr. & Piilani HWY



HCM Signalized Intersection Capacity Analysis
2: Okolani Dr. & Piilani HWY

Austin, Tsutsumi & Associates, Inc.
7/31/2009

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations													
Volume (vph)	185	15	25	40	25	70	10	550	15	35	1275	140	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)	5.0	5.0			5.0		4.0	5.0		4.0	5.0		
Lane Util. Factor	1.00	1.00			1.00		1.00	0.95		1.00	0.95		
Flt Protected	1.00	0.91			0.93		1.00	1.00		1.00	0.99		
Flt Permitted	0.95	1.00			0.99		0.95	1.00		0.95	1.00		
Satd. Flow (prot)	1770	1687			1707		1770	3525		1770	3487		
Satd. Flow (perm)	1357	1687			1558		1770	3525		1770	3487		
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	16	27	43	27	76	11	598	16	38	1386	152	
RTOR Reduction (vph)	0	21	0	0	58	0	0	3	0	0	11	0	
Lane Group Flow (vph)	201	22	0	0	88	0	11	611	0	38	1527	0	
Turn Type	Perm		Perm				Prot		Prot				
Protected Phases	4		8				5		2		1		6
Permitted Phases	4		8										
Actuated Green, G (s)	12.6	12.6			12.6		1.0	24.3		2.7	26.0		
Effective Green, g (s)	12.6	12.6			12.6		1.0	24.3		2.7	26.0		
Actuated g/C Ratio	0.24	0.24			0.24		0.02	0.45		0.05	0.49		
Clearance Time (s)	5.0	5.0			5.0		4.0	5.0		4.0	5.0		
Vehicle Extension (s)	3.0	3.0			3.0		3.0	3.0		3.0	3.0		
Lane Grp Cap (vph)	319	397			366		33	1598		89	1691		
v/s Ratio Prot		0.01					0.01	0.17		c0.02	c0.44		
v/s Ratio Perm	c0.15				0.06								
v/c Ratio	0.63	0.06			0.24		0.33	0.38		0.43	0.90		
Uniform Delay, d1	18.4	15.9			16.6		26.0	9.7		24.7	12.6		
Progression Factor	1.00	1.00			1.00		1.00	1.00		1.00	1.00		
Incremental Delay, d2	4.0	0.1			0.3		5.9	0.7		3.3	8.3		
Delay (s)	22.4	16.0			17.0		31.9	10.4		28.0	21.0		
Level of Service	C	B			B		C	B		C	C		
Approach Delay (s)	21.3		17.0				10.8		21.1				
Approach LOS	C		B				B		C				
Intersection Summary													
HCM Average Control Delay	18.4		HCM Level of Service				B						
HCM Volume to Capacity ratio	0.73												
Actuated Cycle Length (s)	53.6		Sum of lost time (s)				9.0						
Intersection Capacity Utilization	65.0%		ICU Level of Service				C						
Analysis Period (min)	15												
c Critical Lane Group													

HCM Unsignalized Intersection Capacity Analysis
4: Wailea Ike Dr. & Kalai Waa St

Austin, Tsutsumi & Associates, Inc.
7/31/2009

	→	↘	↙	←	↖	↗	
Movement	EBT	EBR	WBL	WBT	NBL	NBR	
Lane Configurations	↑↑		↘	↑↑	↘	↘	
Volume (veh/h)	475	60	245	1170	50	120	
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)	516	65	266	1272	54	130	
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			582		1717	291	
vC1, stage 1 conf vol							
vC2, stage 2 conf vol							
vCu, unblocked vol			582		1717	291	
tC, single (s)			4.1		6.8	6.9	
tC, 2 stage (s)							
tF (s)			2.2		3.5	3.3	
p0 queue free %			73		8	82	
cM capacity (veh/h)			989		59	706	
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	WB 3	NB 1	NB 2
Volume Total	344	237	266	636	636	54	130
Volume Left	0	0	266	0	0	54	0
Volume Right	0	65	0	0	0	0	130
cSH	1700	1700	989	1700	1700	59	706
Volume to Capacity	0.20	0.14	0.27	0.37	0.37	0.92	0.18
Queue Length 95th (ft)	0	0	27	0	0	106	17
Control Delay (s)	0.0	0.0	10.0	0.0	0.0	208.1	11.3
Lane LOS			A			F	B
Approach Delay (s)	0.0		1.7			69.1	
Approach LOS						F	
Intersection Summary							
Average Delay			6.7				
Intersection Capacity Utilization			42.3%	ICU Level of Service		A	
Analysis Period (min)			15				

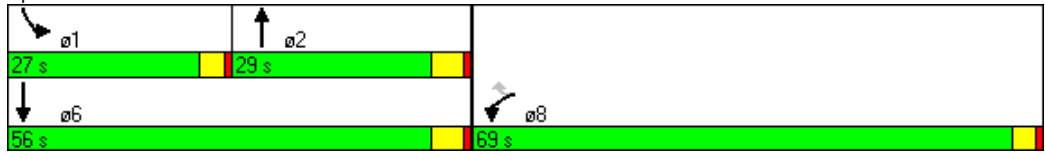
Timings
7: Wailea Ike Dr. & Wailea Alanui Dr.

Austin, Tsutsumi & Associates, Inc.
7/31/2009

	↙	↖	↑	↗	↘	↓
Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↙	↖	↑	↗	↘	↕
Volume (vph)	930	200	195	345	175	455
Turn Type	Perm			Free	Prot	
Protected Phases	8		2		1	6
Permitted Phases		8		Free		
Detector Phase	8	8	2		1	6
Switch Phase						
Minimum Initial (s)	4.0	4.0	4.0		4.0	4.0
Minimum Split (s)	22.0	22.0	24.0		10.0	24.0
Total Split (s)	69.0	69.0	29.0	0.0	27.0	56.0
Total Split (%)	55.2%	55.2%	23.2%	0.0%	21.6%	44.8%
Yellow Time (s)	3.0	3.0	4.0		3.0	4.0
All-Red Time (s)	1.0	1.0	1.0		1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	4.0	5.0	4.0	4.0	5.0
Lead/Lag			Lag		Lead	
Lead-Lag Optimize?			Yes		Yes	
Recall Mode	None	None	None		None	None
Act Effct Green (s)	65.4	65.4	17.7	113.2	17.0	38.7
Actuated g/C Ratio	0.58	0.58	0.16	1.00	0.15	0.34
v/c Ratio	0.99	0.22	0.73	0.24	0.72	0.41
Control Delay	51.3	5.7	60.7	0.4	61.9	28.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	51.3	5.7	60.7	0.4	61.9	28.9
LOS	D	A	E	A	E	C
Approach Delay	43.3		22.2			38.1
Approach LOS	D		C			D













Intersection Summary
 Cycle Length: 125
 Actuated Cycle Length: 113.2
 Natural Cycle: 90
 Control Type: Actuated-Uncoordinated
 Maximum v/c Ratio: 0.99
 Intersection Signal Delay: 36.9
 Intersection LOS: D
 Intersection Capacity Utilization 82.3%
 ICU Level of Service E
 Analysis Period (min) 15

Splits and Phases: 7: Wailea Ike Dr. & Wailea Alanui Dr.

























HCM Signalized Intersection Capacity Analysis
7: Wailea Ike Dr. & Wailea Alanui Dr.

Austin, Tsutsumi & Associates, Inc.
7/31/2009

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	930	200	195	345	175	455
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	5.0	4.0	4.0	5.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	0.95
Flt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1770	1583	1863	1583	1770	3539
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1770	1583	1863	1583	1770	3539
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	1011	217	212	375	190	495
RTOR Reduction (vph)	0	60	0	0	0	0
Lane Group Flow (vph)	1011	157	212	375	190	495
Turn Type		Perm		Free	Prot	
Protected Phases	8		2		1	6
Permitted Phases		8		Free		
Actuated Green, G (s)	65.4	65.4	17.7	113.1	17.0	38.7
Effective Green, g (s)	65.4	65.4	17.7	113.1	17.0	38.7
Actuated g/C Ratio	0.58	0.58	0.16	1.00	0.15	0.34
Clearance Time (s)	4.0	4.0	5.0		4.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	1024	915	292	1583	266	1211
v/s Ratio Prot	c0.57		c0.11		c0.11	0.14
v/s Ratio Perm		0.10		0.24		
v/c Ratio	0.99	0.17	0.73	0.24	0.71	0.41
Uniform Delay, d1	23.4	11.2	45.4	0.0	45.7	28.5
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	24.8	0.1	8.7	0.4	8.8	0.2
Delay (s)	48.2	11.3	54.1	0.4	54.5	28.7
Level of Service	D	B	D	A	D	C
Approach Delay (s)	41.7		19.8			35.8
Approach LOS	D		B			D
Intersection Summary						
HCM Average Control Delay			34.9		HCM Level of Service	C
HCM Volume to Capacity ratio			0.90			
Actuated Cycle Length (s)			113.1		Sum of lost time (s)	13.0
Intersection Capacity Utilization			82.3%		ICU Level of Service	E
Analysis Period (min)			15			
c Critical Lane Group						











HCM Unsignalized Intersection Capacity Analysis
 8: Okolani Dr & Wailea Alanui Dr.

Austin, Tsutsumi & Associates, Inc.
 7/31/2009

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control	Stop			Stop			Stop			Stop		
Volume (vph)	10	50	510	105	65	5	240	30	60	10	70	10
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	54	554	114	71	5	261	33	65	11	76	11
Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	NB 1	NB 2	NB 3	SB 1	SB 2		
Volume Total (vph)	11	54	554	185	5	261	33	65	87	11		
Volume Left (vph)	11	0	0	114	0	261	0	0	11	0		
Volume Right (vph)	0	0	554	0	5	0	0	65	0	11		
Hadj (s)	0.53	0.03	-0.67	0.34	-0.67	0.53	0.03	-0.67	0.10	-0.67		
Departure Headway (s)	6.4	5.9	3.2	6.0	5.0	5.9	5.4	3.2	5.7	4.9		
Degree Utilization, x	0.02	0.09	0.49	0.31	0.01	0.43	0.05	0.06	0.14	0.01		
Capacity (veh/h)	524	570	1116	572	673	593	638	1121	600	684		
Control Delay (s)	8.3	8.2	8.1	10.4	6.8	12.0	7.5	5.2	8.4	6.8		
Approach Delay (s)	8.1			10.3			10.3			8.2		
Approach LOS	A			B			B			A		
Intersection Summary												
Delay	9.1											
HCM Level of Service	A											
Intersection Capacity Utilization	55.0%			ICU Level of Service			B					
Analysis Period (min)	15											

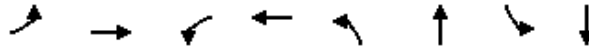
HCM Unsignalized Intersection Capacity Analysis
 9: Kilohana Dr & South Kihei Rd

Austin, Tsutsumi & Associates, Inc.
 7/31/2009

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	10	95	285	10	100	545
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	11	103	310	11	109	592
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)		1				
Median type			None			None
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1125	315			321	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1125	315			321	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	95	86			91	
cM capacity (veh/h)	207	725			1239	
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	114	321	701			
Volume Left	11	0	109			
Volume Right	103	11	0			
cSH	802	1700	1239			
Volume to Capacity	0.14	0.19	0.09			
Queue Length 95th (ft)	12	0	7			
Control Delay (s)	12.0	0.0	2.2			
Lane LOS	B		A			
Approach Delay (s)	12.0	0.0	2.2			
Approach LOS	B					
Intersection Summary						
Average Delay		2.6				
Intersection Capacity Utilization		63.2%		ICU Level of Service		B
Analysis Period (min)		15				

Timings
10: Grand Wailea Resort & Wailea Alanui Dr.

Austin, Tsutsumi & Associates, Inc.
7/31/2009



Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations		↕		↕	↗	↕	↗	↕
Volume (vph)	35	5	10	5	20	410	180	935
Turn Type	Perm		Perm		Perm		Perm	
Protected Phases		4		8		2		6
Permitted Phases	4		8		2		6	
Detector Phase	4	4	8	8	2	2	6	6
Switch Phase								
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	20.0	20.0	20.0	24.0	24.0	24.0	24.0
Total Split (s)	20.0	20.0	20.0	20.0	25.0	25.0	25.0	25.0
Total Split (%)	44.4%	44.4%	44.4%	44.4%	55.6%	55.6%	55.6%	55.6%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode	None	None	None	None	Min	Min	Min	Min
Act Effct Green (s)		6.7		6.6	28.6	28.6	28.6	28.6
Actuated g/C Ratio		0.19		0.18	0.80	0.80	0.80	0.80
v/c Ratio		0.17		0.21	0.06	0.17	0.27	0.40
Control Delay		11.5		8.0	5.6	3.6	6.3	4.7
Queue Delay		0.0		0.0	0.0	0.0	0.0	0.0
Total Delay		11.5		8.0	5.6	3.6	6.3	4.7
LOS		B		A	A	A	A	A
Approach Delay		11.5		8.0		3.7		5.0
Approach LOS		B		A		A		A

Intersection Summary



















Cycle Length: 45
 Actuated Cycle Length: 35.9
 Natural Cycle: 45
 Control Type: Actuated-Uncoordinated
 Maximum v/c Ratio: 0.40
 Intersection Signal Delay: 5.0
 Intersection LOS: A
 Intersection Capacity Utilization 56.9%
 ICU Level of Service B
 Analysis Period (min) 15

Splits and Phases: 10: Grand Wailea Resort & Wailea Alanui Dr.
























HCM Signalized Intersection Capacity Analysis
 10: Grand Wailea Resort & Wailea Alanui Dr.

Austin, Tsutsumi & Associates, Inc.
 7/31/2009

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	35	5	15	10	5	50	20	410	25	180	935	100
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.0			6.0		6.0	6.0		6.0	6.0	
Lane Util. Factor		1.00			1.00		1.00	0.95		1.00	0.95	
Flt Protected		0.96			0.90		1.00	0.99		1.00	0.99	
Flt Permitted		0.97			0.99		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1739			1656		1770	3509		1770	3488	
Satd. Flow (perm)		1795			1555		445	3509		896	3488	
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)	38	5	16	11	5	54	22	446	27	196	1016	109
RTOR Reduction (vph)	0	15	0	0	50	0	0	6	0	0	12	0
Lane Group Flow (vph)	0	44	0	0	20	0	22	467	0	196	1113	0
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)		3.0			3.0		24.7	24.7		24.7	24.7	
Effective Green, g (s)		3.0			3.0		24.7	24.7		24.7	24.7	
Actuated g/C Ratio		0.08			0.08		0.62	0.62		0.62	0.62	
Clearance Time (s)		6.0			6.0		6.0	6.0		6.0	6.0	
Vehicle Extension (s)		3.0			3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		136			118		277	2183		557	2170	
v/s Ratio Prot								0.13			c0.32	
v/s Ratio Perm		c0.02			0.01		0.05			0.22		
v/c Ratio		0.33			0.17		0.08	0.21		0.35	0.51	
Uniform Delay, d1		17.4			17.2		3.0	3.3		3.6	4.2	
Progression Factor		1.00			1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2		1.4			0.7		0.1	0.0		0.4	0.2	
Delay (s)		18.8			17.9		3.1	3.3		4.0	4.4	
Level of Service		B			B		A	A		A	A	
Approach Delay (s)		18.8			17.9			3.3			4.3	
Approach LOS		B			B			A			A	
Intersection Summary												
HCM Average Control Delay			5.0				HCM Level of Service			A		
HCM Volume to Capacity ratio			0.49									
Actuated Cycle Length (s)			39.7				Sum of lost time (s)		12.0			
Intersection Capacity Utilization			56.9%				ICU Level of Service		B			
Analysis Period (min)			15									
c Critical Lane Group												

HCM Unsignalized Intersection Capacity Analysis
 11: Kaukahi Dr & Wailea Alanui Dr.

Austin, Tsutsumi & Associates, Inc.
 9/22/2009

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	30	20	5	55	30	35	5	285	25	20	520	145
Sign Control		Stop			Stop			Free			Free	
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)	33	22	5	60	33	38	5	310	27	22	565	158
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type												
Median storage veh												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	946	929	565	946	1087	310	723			310		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	946	929	565	946	1087	310	723			310		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	84	92	99	73	85	95	99			98		
cM capacity (veh/h)	198	261	524	220	211	730	879			1251		
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2	SB 1	SB 2	SB 3			
Volume Total	33	27	60	71	315	27	22	565	158			
Volume Left	33	0	60	0	5	0	22	0	0			
Volume Right	0	5	0	38	0	27	0	0	158			
cSH	198	290	220	342	879	1700	1251	1700	1700			
Volume to Capacity	0.16	0.09	0.27	0.21	0.01	0.02	0.02	0.33	0.09			
Queue Length 95th (ft)	14	8	27	19	0	0	1	0	0			
Control Delay (s)	26.7	18.7	27.4	18.3	0.2	0.0	7.9	0.0	0.0			
Lane LOS	D	C	D	C	A		A					
Approach Delay (s)	23.0		22.4		0.2		0.2					
Approach LOS	C		C									
Intersection Summary												
Average Delay			3.6									
Intersection Capacity Utilization			44.0%		ICU Level of Service						A	
Analysis Period (min)			15									

Timings
1: Kilohana Dr & Piilani HWY

Austin, Tsutsumi & Associates, Inc.
1/13/2010

	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	175	40	10	35	140	20	1580	15	160	1250	230
Turn Type	Perm		Perm		Perm	Prot		Perm	Prot		Perm
Protected Phases		4		8		5	2		1	6	
Permitted Phases	4		8		8			2			6
Detector Phase	4	4	8	8	8	5	2	2	1	6	6
Switch Phase											
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	12.0	12.0	12.0	12.0	12.0	10.0	24.0	24.0	10.0	24.0	24.0
Total Split (s)	35.0	35.0	35.0	35.0	35.0	10.0	62.0	62.0	23.0	75.0	75.0
Total Split (%)	29.2%	29.2%	29.2%	29.2%	29.2%	8.3%	51.7%	51.7%	19.2%	62.5%	62.5%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	3.0	4.0	4.0	3.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	4.0	5.0	5.0	4.0	5.0	5.0
Lead/Lag						Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?											
Recall Mode	None	None	None	None	None	Min	Max	Max	Min	None	None

Intersection Summary
























Cycle Length: 120
 Actuated Cycle Length: 106.7
 Natural Cycle: 75
 Control Type: Actuated-Uncoordinated

Splits and Phases: 1: Kilohana Dr & Piilani HWY



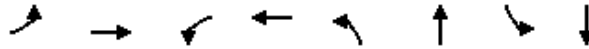
HCM Signalized Intersection Capacity Analysis
1: Kilohana Dr & Piilani HWY

Austin, Tsutsumi & Associates, Inc.
1/13/2010

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	175	40	10	10	35	140	20	1580	15	160	1250	230
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0	5.0	4.0	5.0	5.0	4.0	5.0	5.0
Lane Util. Factor	1.00	1.00		1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Flt Protected	1.00	0.97		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	1806		1770	1863	1583	1770	3539	1583	1770	3539	1583
Satd. Flow (perm)	1364	1806		1345	1863	1583	1770	3539	1583	1770	3539	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)	190	43	11	11	38	152	22	1717	16	174	1359	250
RTOR Reduction (vph)	0	8	0	0	0	123	0	0	5	0	0	94
Lane Group Flow (vph)	190	46	0	11	38	29	22	1717	11	174	1359	156
Turn Type	Perm			Perm		Perm	Prot		Perm	Prot		Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8		8			2			6
Actuated Green, G (s)	20.0	20.0		20.0	20.0	20.0	5.9	57.5	57.5	15.0	66.6	66.6
Effective Green, g (s)	20.0	20.0		20.0	20.0	20.0	5.9	57.5	57.5	15.0	66.6	66.6
Actuated g/C Ratio	0.19	0.19		0.19	0.19	0.19	0.06	0.54	0.54	0.14	0.63	0.63
Clearance Time (s)	5.0	5.0		5.0	5.0	5.0	4.0	5.0	5.0	4.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	256	339		253	350	297	98	1911	855	249	2213	990
v/s Ratio Prot		0.03			0.02		0.01	c0.49		c0.10	0.38	
v/s Ratio Perm	c0.14			0.01		0.02			0.01			0.10
v/c Ratio	0.74	0.14		0.04	0.11	0.10	0.22	0.90	0.01	0.70	0.61	0.16
Uniform Delay, d1	40.8	36.0		35.4	35.9	35.8	48.1	21.9	11.4	43.6	12.1	8.3
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	11.0	0.2		0.1	0.1	0.1	1.2	7.2	0.0	8.3	0.5	0.1
Delay (s)	51.8	36.2		35.5	36.0	35.9	49.3	29.1	11.4	51.9	12.6	8.4
Level of Service	D	D		D	D	D	D	C	B	D	B	A
Approach Delay (s)		48.4			35.9			29.2			15.9	
Approach LOS		D			D			C			B	
Intersection Summary												
HCM Average Control Delay			24.7									HCM Level of Service C
HCM Volume to Capacity ratio			0.83									
Actuated Cycle Length (s)			106.5								14.0	Sum of lost time (s)
Intersection Capacity Utilization			80.6%									ICU Level of Service D
Analysis Period (min)			15									
c Critical Lane Group												

Timings
2: Okolani Dr. & Piilani HWY

Austin, Tsutsumi & Associates, Inc.
7/31/2009



Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations	↖	↗		↕	↖	↗	↖	↗
Volume (vph)	255	35	15	25	40	1255	85	895
Turn Type	Perm		Perm		Prot		Prot	
Protected Phases		4		8	5	2	1	6
Permitted Phases	4		8					
Detector Phase	4	4	8	8	5	2	1	6
Switch Phase								
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	24.0	24.0	24.0	24.0	10.0	24.0	10.0	24.0
Total Split (s)	27.0	27.0	27.0	27.0	12.0	39.0	14.0	41.0
Total Split (%)	33.8%	33.8%	33.8%	33.8%	15.0%	48.8%	17.5%	51.3%
Yellow Time (s)	4.0	4.0	4.0	4.0	3.0	4.0	3.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	4.0	5.0	4.0	5.0
Lead/Lag					Lead	Lag	Lead	Lag
Lead-Lag Optimize?								
Recall Mode	None	None	None	None	None	Max	None	Max
Act Effct Green (s)	18.6	18.6		18.6	7.0	35.8	8.5	39.3
Actuated g/C Ratio	0.25	0.25		0.25	0.09	0.48	0.11	0.53
v/c Ratio	0.80	0.16		0.22	0.26	0.84	0.46	0.69
Control Delay	45.0	14.6		13.2	37.4	25.2	40.0	17.1
Queue Delay	0.0	0.0		0.0	0.0	0.0	0.0	0.0
Total Delay	45.0	14.6		13.2	37.4	25.2	40.0	17.1
LOS	D	B		B	D	C	D	B
Approach Delay		38.8		13.2		25.6		18.6
Approach LOS		D		B		C		B

Intersection Summary




















Cycle Length: 80
 Actuated Cycle Length: 74.6
 Natural Cycle: 65
 Control Type: Actuated-Uncoordinated
 Maximum v/c Ratio: 0.84
 Intersection Signal Delay: 23.7
 Intersection LOS: C
 Intersection Capacity Utilization 73.3%
 ICU Level of Service D
 Analysis Period (min) 15

Splits and Phases: 2: Okolani Dr. & Piilani HWY



HCM Signalized Intersection Capacity Analysis
2: Okolani Dr. & Piilani HWY

Austin, Tsutsumi & Associates, Inc.
7/31/2009

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	255	35	30	15	25	50	40	1255	45	85	895	270
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0			5.0		4.0	5.0		4.0	5.0	
Lane Util. Factor	1.00	1.00			1.00		1.00	0.95		1.00	0.95	
Flt Protected	1.00	0.93			0.92		1.00	0.99		1.00	0.97	
Flt Permitted	0.95	1.00			0.99		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1733			1709		1770	3521		1770	3416	
Satd. Flow (perm)	1393	1733			1644		1770	3521		1770	3416	
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)	277	38	33	16	27	54	43	1364	49	92	973	293
RTOR Reduction (vph)	0	25	0	0	41	0	0	3	0	0	31	0
Lane Group Flow (vph)	277	46	0	0	56	0	43	1410	0	92	1235	0
Turn Type	Perm		Perm			Prot			Prot			
Protected Phases	4		8			5		2		1		6
Permitted Phases	4		8									
Actuated Green, G (s)	18.6	18.6			18.6		4.4	36.6		7.1	39.3	
Effective Green, g (s)	18.6	18.6			18.6		4.4	36.6		7.1	39.3	
Actuated g/C Ratio	0.24	0.24			0.24		0.06	0.48		0.09	0.52	
Clearance Time (s)	5.0	5.0			5.0		4.0	5.0		4.0	5.0	
Vehicle Extension (s)	3.0	3.0			3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	340	422			401		102	1689		165	1759	
v/s Ratio Prot		0.03					0.02	c0.40		c0.05	c0.36	
v/s Ratio Perm	c0.20				0.03							
v/c Ratio	0.81	0.11			0.14		0.42	0.83		0.56	0.70	
Uniform Delay, d1	27.2	22.4			22.6		34.7	17.2		33.1	14.1	
Progression Factor	1.00	1.00			1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	13.9	0.1			0.2		2.8	5.0		4.0	2.4	
Delay (s)	41.1	22.5			22.7		37.5	22.3		37.1	16.4	
Level of Service	D	C			C		D	C		D	B	
Approach Delay (s)	37.3				22.7		22.7			17.8		
Approach LOS	D				C		C			B		
Intersection Summary												
HCM Average Control Delay			22.2		HCM Level of Service				C			
HCM Volume to Capacity ratio			0.86									
Actuated Cycle Length (s)			76.3		Sum of lost time (s)				19.0			
Intersection Capacity Utilization			73.3%		ICU Level of Service				D			
Analysis Period (min)			15									
c Critical Lane Group												













HCM Unsignalized Intersection Capacity Analysis
4: Wailea Ike Dr. & Kalai Waa St

Austin, Tsutsumi & Associates, Inc.
7/31/2009

	→	↘	↙	←	↖	↗		
Movement	EBT	EBR	WBL	WBT	NBL	NBR		
Lane Configurations	↑↑		↘	↑↑	↘	↗		
Volume (veh/h)	1130	90	160	795	100	280		
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)	1228	98	174	864	109	304		
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			1326		2057	663		
vC1, stage 1 conf vol								
vC2, stage 2 conf vol								
vCu, unblocked vol			1326		2057	663		
tC, single (s)			4.1		6.8	6.9		
tC, 2 stage (s)								
tF (s)			2.2		3.5	3.3		
p0 queue free %			66		0	25		
cM capacity (veh/h)			517		32	404		
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	WB 3	NB 1	NB 2	
Volume Total	819	507	174	432	432	109	304	
Volume Left	0	0	174	0	0	109	0	
Volume Right	0	98	0	0	0	0	304	
cSH	1700	1700	517	1700	1700	32	404	
Volume to Capacity	0.48	0.30	0.34	0.25	0.25	3.44	0.75	
Queue Length 95th (ft)	0	0	37	0	0	Err	154	
Control Delay (s)	0.0	0.0	15.5	0.0	0.0	Err	36.6	
Lane LOS			C				F	E
Approach Delay (s)	0.0		2.6		2658.3			
Approach LOS					F			
Intersection Summary								
Average Delay			396.3					
Intersection Capacity Utilization			58.5%		ICU Level of Service		B	
Analysis Period (min)			15					























HCM Signalized Intersection Capacity Analysis
7: Wailea Ike Dr. & Wailea Alanui Dr.

Austin, Tsutsumi & Associates, Inc.
7/31/2009

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	570	265	435	835	265	400
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	5.0	4.0	4.0	5.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	0.95
Flt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1770	1583	1863	1583	1770	3539
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1770	1583	1863	1583	1770	3539
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	620	288	473	908	288	435
RTOR Reduction (vph)	0	177	0	0	0	0
Lane Group Flow (vph)	620	111	473	908	288	435
Turn Type		Perm		Free	Prot	
Protected Phases	8		2		1	6
Permitted Phases		8		Free		
Actuated Green, G (s)	33.0	33.0	23.6	85.8	16.2	43.8
Effective Green, g (s)	33.0	33.0	23.6	85.8	16.2	43.8
Actuated g/C Ratio	0.38	0.38	0.28	1.00	0.19	0.51
Clearance Time (s)	4.0	4.0	5.0		4.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	681	609	512	1583	334	1807
v/s Ratio Prot	c0.35		c0.25		c0.16	0.12
v/s Ratio Perm		0.07		0.57		
v/c Ratio	0.91	0.18	0.92	0.57	0.86	0.24
Uniform Delay, d1	25.0	17.5	30.2	0.0	33.7	11.7
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	16.4	0.1	22.5	1.5	19.8	0.1
Delay (s)	41.4	17.6	52.7	1.5	53.6	11.8
Level of Service	D	B	D	A	D	B
Approach Delay (s)	33.8		19.0			28.4
Approach LOS	C		B			C
Intersection Summary						
HCM Average Control Delay			25.8		HCM Level of Service	C
HCM Volume to Capacity ratio			0.90			
Actuated Cycle Length (s)			85.8		Sum of lost time (s)	13.0
Intersection Capacity Utilization			80.0%		ICU Level of Service	D
Analysis Period (min)			15			
c Critical Lane Group						











HCM Unsignalized Intersection Capacity Analysis
 8: Okolani Dr & Wailea Alanui Dr.

Austin, Tsutsumi & Associates, Inc.
 7/31/2009

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control	Stop			Stop			Stop			Stop		
Volume (vph)	15	95	460	100	70	15	510	110	145	15	35	15
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)	16	103	500	109	76	16	554	120	158	16	38	16
Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	NB 1	NB 2	NB 3	SB 1	SB 2		
Volume Total (vph)	16	103	500	185	16	554	120	158	54	16		
Volume Left (vph)	16	0	0	109	0	554	0	0	16	0		
Volume Right (vph)	0	0	500	0	16	0	0	158	0	16		
Hadj (s)	0.53	0.03	-0.67	0.33	-0.67	0.53	0.03	-0.67	0.18	-0.67		
Departure Headway (s)	7.5	7.0	3.2	7.1	6.1	6.2	5.7	3.2	6.7	5.8		
Degree Utilization, x	0.03	0.20	0.44	0.36	0.03	0.96	0.19	0.14	0.10	0.03		
Capacity (veh/h)	461	498	1115	493	565	574	614	1121	513	582		
Control Delay (s)	9.5	10.5	7.5	12.9	8.1	50.6	8.8	5.5	9.2	7.8		
Approach Delay (s)	8.1			12.5			36.1			8.9		
Approach LOS	A			B			E			A		
Intersection Summary												
Delay	22.1											
HCM Level of Service	C											
Intersection Capacity Utilization	57.5%			ICU Level of Service			B					
Analysis Period (min)	15											

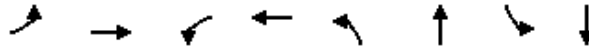
HCM Unsignalized Intersection Capacity Analysis
 9: Kilohana Dr & South Kihei Rd

Austin, Tsutsumi & Associates, Inc.
 7/31/2009

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	35	155	570	25	100	540
Sign Control	Stop		Free		Free	
Grade	0%		0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	38	168	620	27	109	587
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)	1					
Median type			None		None	
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1438	633			647	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1438	633			647	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	71	65			88	
cM capacity (veh/h)	130	480			939	
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	207	647	696			
Volume Left	38	0	109			
Volume Right	168	27	0			
cSH	588	1700	939			
Volume to Capacity	0.35	0.38	0.12			
Queue Length 95th (ft)	39	0	10			
Control Delay (s)	21.6	0.0	2.9			
Lane LOS	C		A			
Approach Delay (s)	21.6	0.0	2.9			
Approach LOS	C					
Intersection Summary						
Average Delay			4.2			
Intersection Capacity Utilization			78.8%	ICU Level of Service	D	
Analysis Period (min)			15			

Timings
10: Grand Wailea Resort & Wailea Alanui Dr.

Austin, Tsutsumi & Associates, Inc.
7/31/2009

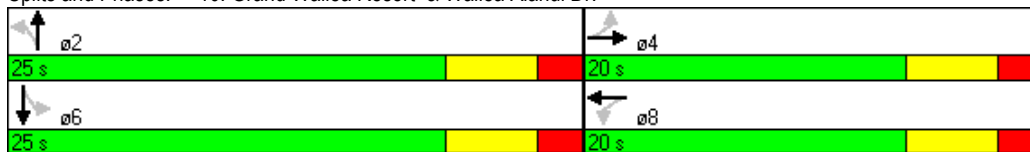


Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations		↕		↕	↖	↗	↖	↗
Volume (vph)	105	5	10	15	30	980	60	660
Turn Type	Perm		Perm		Perm		Perm	
Protected Phases		4		8		2		6
Permitted Phases	4		8		2		6	
Detector Phase	4	4	8	8	2	2	6	6
Switch Phase								
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	20.0	20.0	20.0	24.0	24.0	24.0	24.0
Total Split (s)	20.0	20.0	20.0	20.0	25.0	25.0	25.0	25.0
Total Split (%)	44.4%	44.4%	44.4%	44.4%	55.6%	55.6%	55.6%	55.6%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode	None	None	None	None	Min	Min	Min	Min
Act Effct Green (s)		9.2		9.2	23.3	23.3	23.3	23.3
Actuated g/C Ratio		0.23		0.23	0.58	0.58	0.58	0.58
v/c Ratio		0.45		0.20	0.09	0.52	0.26	0.39
Control Delay		16.2		8.9	8.0	9.1	11.8	7.7
Queue Delay		0.0		0.0	0.0	0.0	0.0	0.0
Total Delay		16.2		8.9	8.0	9.1	11.8	7.7
LOS		B		A	A	A	B	A
Approach Delay		16.2		8.9		9.1		8.0
Approach LOS		B		A		A		A

Intersection Summary



















Cycle Length: 45
 Actuated Cycle Length: 40.1
 Natural Cycle: 45
 Control Type: Actuated-Uncoordinated
 Maximum v/c Ratio: 0.52
 Intersection Signal Delay: 9.1
 Intersection LOS: A
 Intersection Capacity Utilization 60.0%
 ICU Level of Service B
 Analysis Period (min) 15

Splits and Phases: 10: Grand Wailea Resort & Wailea Alanui Dr.
























HCM Signalized Intersection Capacity Analysis
 10: Grand Wailea Resort & Wailea Alanui Dr.

Austin, Tsutsumi & Associates, Inc.
 7/31/2009

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations													
Volume (vph)	105	5	25	10	15	45	30	980	10	60	660	70	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)		6.0			6.0		6.0	6.0		6.0	6.0		
Lane Util. Factor		1.00			1.00		1.00	0.95		1.00	0.95		
Flt Protected		0.98			0.91		1.00	1.00		1.00	0.99		
Flt Permitted		0.96			0.99		0.95	1.00		0.95	1.00		
Satd. Flow (prot)		1748			1688		1770	3534		1770	3488		
Satd. Flow (perm)		1313			1565		655	3534		426	3488		
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)	114	5	27	11	16	49	33	1065	11	65	717	76	
RTOR Reduction (vph)	0	21	0	0	29	0	0	1	0	0	15	0	
Lane Group Flow (vph)	0	125	0	0	47	0	33	1075	0	65	778	0	
Turn Type	Perm			Perm			Perm			Perm			
Protected Phases		4			8			2			6		
Permitted Phases	4			8			2			6			
Actuated Green, G (s)		7.7			7.7		21.7	21.7		21.7	21.7		
Effective Green, g (s)		7.7			7.7		21.7	21.7		21.7	21.7		
Actuated g/C Ratio		0.19			0.19		0.52	0.52		0.52	0.52		
Clearance Time (s)		6.0			6.0		6.0	6.0		6.0	6.0		
Vehicle Extension (s)		3.0			3.0		3.0	3.0		3.0	3.0		
Lane Grp Cap (vph)		244			291		343	1852		223	1828		
v/s Ratio Prot								c0.30			0.22		
v/s Ratio Perm		c0.10			0.03		0.05			0.15			
v/c Ratio		0.51			0.16		0.10	0.58		0.29	0.43		
Uniform Delay, d1		15.2			14.1		4.9	6.7		5.5	6.0		
Progression Factor		1.00			1.00		1.00	1.00		1.00	1.00		
Incremental Delay, d2		1.8			0.3		0.1	0.5		0.7	0.2		
Delay (s)		17.0			14.4		5.1	7.2		6.3	6.2		
Level of Service		B			B		A	A		A	A		
Approach Delay (s)		17.0			14.4			7.1			6.2		
Approach LOS		B			B			A			A		
Intersection Summary													
HCM Average Control Delay			7.7									HCM Level of Service	A
HCM Volume to Capacity ratio			0.56										
Actuated Cycle Length (s)			41.4									Sum of lost time (s)	12.0
Intersection Capacity Utilization			60.0%									ICU Level of Service	B
Analysis Period (min)			15										
c Critical Lane Group													

HCM Unsignalized Intersection Capacity Analysis
 11: Kaukahi Dr & Wailea Alanui Dr.

Austin, Tsutsumi & Associates, Inc.
 9/22/2009

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	95	25	10	45	15	5	10	640	55	35	520	65
Sign Control		Stop			Stop			Free			Free	
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)	103	27	11	49	16	5	11	696	60	38	565	71
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	1367	1359	565	1383	1429	696	636			696		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1367	1359	565	1383	1429	696	636			696		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	3	81	98	50	87	99	99			96		
cM capacity (veh/h)	106	141	524	97	128	442	948			900		
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2	SB 1	SB 2	SB 3			
Volume Total	103	38	49	22	707	60	38	565	71			
Volume Left	103	0	49	0	11	0	38	0	0			
Volume Right	0	11	0	5	0	60	0	0	71			
cSH	106	178	97	155	948	1700	900	1700	1700			
Volume to Capacity	0.97	0.21	0.50	0.14	0.01	0.04	0.04	0.33	0.04			
Queue Length 95th (ft)	151	20	56	12	1	0	3	0	0			
Control Delay (s)	154.4	30.7	75.1	32.0	0.3	0.0	9.2	0.0	0.0			
Lane LOS	F	D	F	D	A		A					
Approach Delay (s)	121.1		61.8		0.3		0.5					
Approach LOS	F		F									
Intersection Summary												
Average Delay			13.3									
Intersection Capacity Utilization			60.3%		ICU Level of Service					B		
Analysis Period (min)			15									



APPENDIX C

LEVEL OF SERVICE CALCULATIONS

- Future Year 2016 WITH Project
-

Timings
1: Kilohana Dr & Piilani HWY

Austin, Tsutsumi & Associates, Inc.
1/13/2010

	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	155	20	15	25	155	5	805	5	50	1395	150
Turn Type	Perm		Perm		Perm	Prot		Perm	Prot		Perm
Protected Phases		4		8		5	2		1	6	
Permitted Phases	4		8		8			2			6
Detector Phase	4	4	8	8	8	5	2	2	1	6	6
Switch Phase											
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	12.0	12.0	12.0	12.0	12.0	10.0	24.0	24.0	10.0	24.0	24.0
Total Split (s)	35.0	35.0	35.0	35.0	35.0	10.0	62.0	62.0	23.0	75.0	75.0
Total Split (%)	29.2%	29.2%	29.2%	29.2%	29.2%	8.3%	51.7%	51.7%	19.2%	62.5%	62.5%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	3.0	4.0	4.0	3.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	4.0	5.0	5.0	4.0	5.0	5.0
Lead/Lag						Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?						Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	Min	Max	Max	Min	Max	Max

Intersection Summary

Cycle Length: 120
 Actuated Cycle Length: 108.3
 Natural Cycle: 60
 Control Type: Actuated-Uncoordinated

Splits and Phases: 1: Kilohana Dr & Piilani HWY



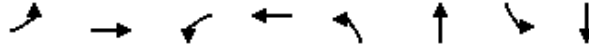
HCM Signalized Intersection Capacity Analysis
 1: Kilohana Dr & Piilani HWY

Austin, Tsutsumi & Associates, Inc.
 1/13/2010

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations	↗	↘		↗	↘	↗	↗	↗	↗	↗	↗	↗	
Volume (vph)	155	20	10	15	25	155	5	805	5	50	1395	150	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)	5.0	5.0		5.0	5.0	5.0	4.0	5.0	5.0	4.0	5.0	5.0	
Lane Util. Factor	1.00	1.00		1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Flt Protected	1.00	0.95		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1770	1770		1770	1863	1583	1770	3539	1583	1770	3539	1583	
Satd. Flow (perm)	1378	1770		1370	1863	1583	1770	3539	1583	1770	3539	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)	168	22	11	16	27	168	5	875	5	54	1516	163	
RTOR Reduction (vph)	0	9	0	0	0	140	0	0	2	0	0	57	
Lane Group Flow (vph)	168	24	0	16	27	28	5	875	3	54	1516	106	
Turn Type	Perm			Perm		Perm	Prot		Perm	Prot		Perm	
Protected Phases		4			8		5	2		1	6		
Permitted Phases	4			8		8			2			6	
Actuated Green, G (s)	18.3	18.3		18.3	18.3	18.3	5.7	67.2	67.2	8.7	70.2	70.2	
Effective Green, g (s)	18.3	18.3		18.3	18.3	18.3	5.7	67.2	67.2	8.7	70.2	70.2	
Actuated g/C Ratio	0.17	0.17		0.17	0.17	0.17	0.05	0.62	0.62	0.08	0.65	0.65	
Clearance Time (s)	5.0	5.0		5.0	5.0	5.0	4.0	5.0	5.0	4.0	5.0	5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	233	299		232	315	268	93	2198	983	142	2296	1027	
v/s Ratio Prot		0.01			0.01		0.00	0.25		c0.03	c0.43		
v/s Ratio Perm	c0.12			0.01		0.02			0.00			0.07	
v/c Ratio	0.72	0.08		0.07	0.09	0.11	0.05	0.40	0.00	0.38	0.66	0.10	
Uniform Delay, d1	42.5	37.9		37.8	37.9	38.0	48.7	10.3	7.8	47.2	11.7	7.2	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	10.5	0.1		0.1	0.1	0.2	0.2	0.5	0.0	1.7	1.5	0.2	
Delay (s)	53.0	38.0		37.9	38.0	38.2	48.9	10.9	7.8	48.9	13.2	7.4	
Level of Service	D	D		D	D	D	D	B	A	D	B	A	
Approach Delay (s)		50.5			38.2			11.1			13.7		
Approach LOS		D			D			B			B		
Intersection Summary													
HCM Average Control Delay			17.1									HCM Level of Service	B
HCM Volume to Capacity ratio			0.66										
Actuated Cycle Length (s)			108.2									Sum of lost time (s)	14.0
Intersection Capacity Utilization			65.1%									ICU Level of Service	C
Analysis Period (min)			15										
c Critical Lane Group													

Timings
2: Okolani Dr. & Piilani HWY

Austin, Tsutsumi & Associates, Inc.
10/19/2009



Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations	↶	↷		↻	↶	↷	↶	↷
Volume (vph)	185	15	35	20	10	560	35	1210
Turn Type	Perm		Perm		Prot		Prot	
Protected Phases		4		8	5	2	1	6
Permitted Phases	4		8					
Detector Phase	4	4	8	8	5	2	1	6
Switch Phase								
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	24.0	24.0	24.0	24.0	10.0	24.0	10.0	24.0
Total Split (s)	27.0	27.0	27.0	27.0	12.0	39.0	14.0	41.0
Total Split (%)	33.8%	33.8%	33.8%	33.8%	15.0%	48.8%	17.5%	51.3%
Yellow Time (s)	4.0	4.0	4.0	4.0	3.0	4.0	3.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	4.0	5.0	4.0	5.0
Lead/Lag					Lead	Lag	Lead	Lag
Lead-Lag Optimize?					Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	Max	None	Max

Intersection Summary





















Cycle Length: 80
 Actuated Cycle Length: 68
 Natural Cycle: 70
 Control Type: Actuated-Uncoordinated

Splits and Phases: 2: Okolani Dr. & Piilani HWY



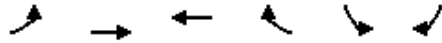
HCM Signalized Intersection Capacity Analysis
2: Okolani Dr. & Piilani HWY

Austin, Tsutsumi & Associates, Inc.
10/19/2009

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	185	15	25	35	20	70	10	560	15	35	1210	135
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0			5.0		4.0	5.0		4.0	5.0	
Lane Util. Factor	1.00	1.00			1.00		1.00	0.95		1.00	0.95	
Flt Protected	1.00	0.91			0.92		1.00	1.00		1.00	0.98	
Flt Permitted	0.95	1.00			0.99		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1687			1698		1770	3526		1770	3486	
Satd. Flow (perm)	1263	1687			1566		1770	3526		1770	3486	
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	16	27	38	22	76	11	609	16	38	1315	147
RTOR Reduction (vph)	0	21	0	0	59	0	0	2	0	0	8	0
Lane Group Flow (vph)	201	22	0	0	77	0	11	623	0	38	1454	0
Turn Type	Perm		Perm				Prot		Prot			
Protected Phases	4		8				5		2			
Permitted Phases	4		8									
Actuated Green, G (s)	15.7	15.7			15.7		1.2	38.4		3.0	40.2	
Effective Green, g (s)	15.7	15.7			15.7		1.2	38.4		3.0	40.2	
Actuated g/C Ratio	0.22	0.22			0.22		0.02	0.54		0.04	0.57	
Clearance Time (s)	5.0	5.0			5.0		4.0	5.0		4.0	5.0	
Vehicle Extension (s)	3.0	3.0			3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	279	373			346		30	1904		75	1971	
v/s Ratio Prot		0.01					0.01	0.18		c0.02	c0.42	
v/s Ratio Perm	c0.16		0.05									
v/c Ratio	0.72	0.06			0.22		0.37	0.33		0.51	0.74	
Uniform Delay, d1	25.7	21.9			22.7		34.6	9.1		33.3	11.5	
Progression Factor	1.00	1.00			1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	8.8	0.1			0.3		7.4	0.5		5.3	2.5	
Delay (s)	34.5	21.9			23.0		42.0	9.6		38.6	14.0	
Level of Service	C	C			C		D	A		D	B	
Approach Delay (s)	32.3		23.0				10.2		14.7			
Approach LOS	C		C				B		B			
Intersection Summary												
HCM Average Control Delay	15.7		HCM Level of Service				B					
HCM Volume to Capacity ratio	0.68											
Actuated Cycle Length (s)	71.1		Sum of lost time (s)				9.0					
Intersection Capacity Utilization	63.0%		ICU Level of Service				B					
Analysis Period (min)	15											
c Critical Lane Group												

Timings
3: Wailea Ike Dr. & Piilani HWY

Austin, Tsutsumi & Associates, Inc.
10/19/2009



Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	↖↖	↑	↑	↗	↘	↗
Volume (vph)	525	55	40	110	150	1210
Turn Type	Prot			Perm		Free
Protected Phases	7	4	8		1	
Permitted Phases				8		Free
Detector Phase	7	4	8	8	1	
Switch Phase						
Minimum Initial (s)	4.0	4.0	4.0	4.0	3.0	
Minimum Split (s)	24.0	24.0	24.0	24.0	7.0	
Total Split (s)	52.0	54.0	24.0	24.0	17.0	0.0
Total Split (%)	55.9%	58.1%	25.8%	25.8%	18.3%	0.0%
Yellow Time (s)	3.0	4.0	4.0	4.0	3.0	
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	5.0	5.0	5.0	4.0	4.0
Lead/Lag	Lead		Lag	Lag		
Lead-Lag Optimize?						
Recall Mode	None	None	None	None	None	

Intersection Summary

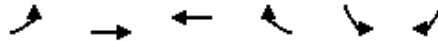
Cycle Length: 93
 Actuated Cycle Length: 38.4
 Natural Cycle: 60
 Control Type: Actuated-Uncoordinated

Splits and Phases: 3: Wailea Ike Dr. & Piilani HWY



HCM Signalized Intersection Capacity Analysis
 3: Wailea Ike Dr. & Piilani HWY

Austin, Tsutsumi & Associates, Inc.
 10/19/2009



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	↗↘	↑	↑	↗	↘	↗
Volume (vph)	525	55	40	110	150	1210
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	5.0	5.0	5.0	4.0	4.0
Lane Util. Factor	0.97	1.00	1.00	1.00	1.00	1.00
Flt	1.00	1.00	1.00	0.85	1.00	0.85
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	3433	1863	1863	1583	1770	1583
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	3433	1863	1863	1583	1770	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	571	60	43	120	163	1315
RTOR Reduction (vph)	0	0	0	105	0	0
Lane Group Flow (vph)	571	60	43	15	163	1315
Turn Type	Prot		Perm		Free	
Protected Phases	7	4	8		1	
Permitted Phases				8		Free
Actuated Green, G (s)	14.2	23.0	4.8	4.8	7.2	39.2
Effective Green, g (s)	14.2	23.0	4.8	4.8	7.2	39.2
Actuated g/C Ratio	0.36	0.59	0.12	0.12	0.18	1.00
Clearance Time (s)	4.0	5.0	5.0	5.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	1244	1093	228	194	325	1583
v/s Ratio Prot	0.17	0.03	0.02		0.09	
v/s Ratio Perm				0.01		c0.83
v/c Ratio	0.46	0.05	0.19	0.08	0.50	0.83
Uniform Delay, d1	9.6	3.5	15.5	15.2	14.4	0.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.3	0.0	0.4	0.2	1.2	5.2
Delay (s)	9.8	3.5	15.9	15.4	15.6	5.2
Level of Service	A	A	B	B	B	A
Approach Delay (s)		9.2	15.5		6.4	
Approach LOS		A	B		A	

Intersection Summary			
HCM Average Control Delay		7.8	HCM Level of Service A
HCM Volume to Capacity ratio		0.83	
Actuated Cycle Length (s)		39.2	Sum of lost time (s) 0.0
Intersection Capacity Utilization		37.5%	ICU Level of Service A
Analysis Period (min)		15	
c Critical Lane Group			

HCM Unsignalized Intersection Capacity Analysis
 4: Wailea Ike Dr. & Kalai Waa St

Austin, Tsutsumi & Associates, Inc.
 10/19/2009

	→	↘	↙	←	↖	↗		
Movement	EBT	EBR	WBL	WBT	NBL	NBR		
Lane Configurations	↑↑		↘	↑↑	↘	↘		
Volume (veh/h)	455	25	130	1100	35	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)	495	27	141	1196	38	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)				749				
pX, platoon unblocked								
vC, conflicting volume			522		1389		261	
vC1, stage 1 conf vol								
vC2, stage 2 conf vol								
vCu, unblocked vol			522		1389		261	
tC, single (s)			4.1		6.8		6.9	
tC, 2 stage (s)								
tF (s)			2.2		3.5		3.3	
p0 queue free %			86		67		88	
cM capacity (veh/h)			1041		115		738	
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	WB 3	NB 1	NB 2	
Volume Total	330	192	141	598	598	38	87	
Volume Left	0	0	141	0	0	38	0	
Volume Right	0	27	0	0	0	0	87	
cSH	1700	1700	1041	1700	1700	115	738	
Volume to Capacity	0.19	0.11	0.14	0.35	0.35	0.33	0.12	
Queue Length 95th (ft)	0	0	12	0	0	32	10	
Control Delay (s)	0.0	0.0	9.0	0.0	0.0	50.8	10.5	
Lane LOS				A			F B	
Approach Delay (s)	0.0		1.0			22.8		
Approach LOS						C		
Intersection Summary								
Average Delay			2.1					
Intersection Capacity Utilization			40.4%			ICU Level of Service		A
Analysis Period (min)			15					

Timings
7: Wailea Ike Dr. & Wailea Alanui Dr.

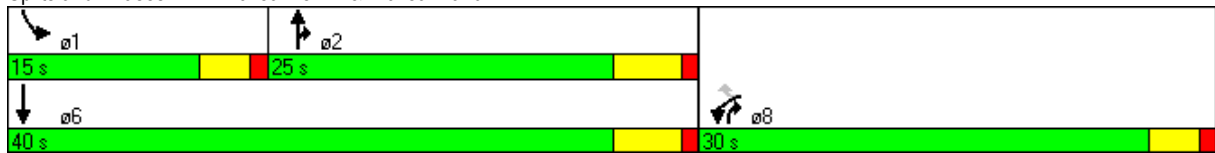
Austin, Tsutsumi & Associates, Inc.
10/19/2009

	↙	↖	↑	↗	↘	↓
Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↖↗	↖	↑	↗↖	↘	↖↗
Volume (vph)	860	190	175	320	145	425
Turn Type		Perm		pt+ov	Prot	
Protected Phases	8		2	2 8	1	6
Permitted Phases		8				
Detector Phase	8	8	2	2 8	1	6
Switch Phase						
Minimum Initial (s)	4.0	4.0	4.0		4.0	4.0
Minimum Split (s)	22.0	22.0	24.0		10.0	24.0
Total Split (s)	30.0	30.0	25.0	55.0	15.0	40.0
Total Split (%)	42.9%	42.9%	35.7%	78.6%	21.4%	57.1%
Yellow Time (s)	3.0	3.0	4.0		3.0	4.0
All-Red Time (s)	1.0	1.0	1.0		1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	4.0	5.0	5.0	4.0	5.0
Lead/Lag			Lag		Lead	
Lead-Lag Optimize?			Yes		Yes	
Recall Mode	None	None	Max		None	Max

Intersection Summary
















Cycle Length: 70
 Actuated Cycle Length: 67.5
 Natural Cycle: 60
 Control Type: Actuated-Uncoordinated

Splits and Phases: 7: Wailea Ike Dr. & Wailea Alanui Dr.

























HCM Signalized Intersection Capacity Analysis
7: Wailea Ike Dr. & Wailea Alanui Dr.

Austin, Tsutsumi & Associates, Inc.
10/19/2009

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	 			 		 
Volume (vph)	860	190	175	320	145	425
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	5.0	5.0	4.0	5.0
Lane Util. Factor	0.97	1.00	1.00	0.88	1.00	0.95
Flt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	3433	1583	1863	2787	1770	3539
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	3433	1583	1863	2787	1770	3539
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	935	207	190	348	158	462
RTOR Reduction (vph)	0	136	0	83	0	0
Lane Group Flow (vph)	935	71	190	265	158	462
Turn Type		Perm		pt+ov	Prot	
Protected Phases	8		2	2 8	1	6
Permitted Phases		8				
Actuated Green, G (s)	23.3	23.3	23.7	52.0	8.3	36.0
Effective Green, g (s)	23.3	23.3	23.7	52.0	8.3	36.0
Actuated g/C Ratio	0.34	0.34	0.35	0.76	0.12	0.53
Clearance Time (s)	4.0	4.0	5.0		4.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	1171	540	646	2122	215	1865
v/s Ratio Prot	c0.27		c0.10	0.10	c0.09	0.13
v/s Ratio Perm		0.04				
v/c Ratio	0.80	0.13	0.29	0.12	0.73	0.25
Uniform Delay, d1	20.4	15.5	16.2	2.1	28.9	8.8
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	3.9	0.1	1.2	0.0	12.2	0.3
Delay (s)	24.3	15.6	17.4	2.2	41.2	9.1
Level of Service	C	B	B	A	D	A
Approach Delay (s)	22.7		7.5			17.3
Approach LOS	C		A			B
Intersection Summary						
HCM Average Control Delay			17.7		HCM Level of Service	B
HCM Volume to Capacity ratio			0.57			
Actuated Cycle Length (s)			68.3		Sum of lost time (s)	13.0
Intersection Capacity Utilization			52.6%		ICU Level of Service	A
Analysis Period (min)			15			
c Critical Lane Group						











HCM Unsignalized Intersection Capacity Analysis
 8: Okolani Dr & Wailea Alanui Dr.

Austin, Tsutsumi & Associates, Inc.
 10/19/2009

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control	Stop			Stop			Stop			Stop		
Volume (vph)	10	50	450	100	65	5	210	30	55	10	70	10
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	54	489	109	71	5	228	33	60	11	76	11
Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	NB 1	NB 2	NB 3	SB 1	SB 2		
Volume Total (vph)	11	54	489	179	5	228	33	60	87	11		
Volume Left (vph)	11	0	0	109	0	228	0	0	11	0		
Volume Right (vph)	0	0	489	0	5	0	0	60	0	11		
Hadj (s)	0.53	0.03	-0.67	0.34	-0.67	0.53	0.03	-0.67	0.10	-0.67		
Departure Headway (s)	6.3	5.8	3.2	5.9	4.9	5.9	5.4	3.2	5.6	4.9		
Degree Utilization, x	0.02	0.09	0.43	0.29	0.01	0.37	0.05	0.05	0.14	0.01		
Capacity (veh/h)	536	585	1115	583	689	594	641	1121	608	695		
Control Delay (s)	8.2	8.1	7.4	10.1	6.7	11.1	7.4	5.2	8.3	6.7		
Approach Delay (s)	7.5			10.0			9.6			8.1		
Approach LOS	A			B			A			A		
Intersection Summary												
Delay	8.5											
HCM Level of Service	A											
Intersection Capacity Utilization	51.1%			ICU Level of Service			A					
Analysis Period (min)	15											

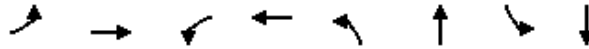
HCM Unsignalized Intersection Capacity Analysis
 9: Kilohana Dr & South Kihei Rd

Austin, Tsutsumi & Associates, Inc.
 10/19/2009

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	10	95	260	10	95	485
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	11	103	283	11	103	527
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)		1				
Median type			None			None
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1022	288			293	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1022	288			293	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	95	86			92	
cM capacity (veh/h)	240	751			1268	
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	114	293	630			
Volume Left	11	0	103			
Volume Right	103	11	0			
cSH	830	1700	1268			
Volume to Capacity	0.14	0.17	0.08			
Queue Length 95th (ft)	12	0	7			
Control Delay (s)	11.5	0.0	2.1			
Lane LOS	B		A			
Approach Delay (s)	11.5	0.0	2.1			
Approach LOS	B					
Intersection Summary						
Average Delay		2.6				
Intersection Capacity Utilization		58.4%		ICU Level of Service		B
Analysis Period (min)		15				

Timings
10: Grand Wailea Resort & Wailea Alanui Dr.

Austin, Tsutsumi & Associates, Inc.
10/19/2009

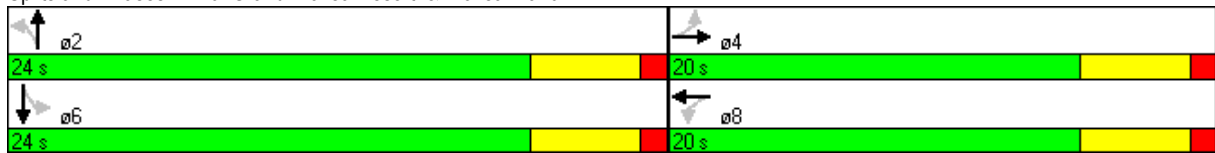


Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations		↕		↕	↗	↕	↗	↕
Volume (vph)	35	5	10	5	20	370	180	840
Turn Type	Perm		Perm		Perm		Perm	
Protected Phases		4		8		2		6
Permitted Phases	4		8		2		6	
Detector Phase	4	4	8	8	2	2	6	6
Switch Phase								
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	20.0	20.0	20.0	24.0	24.0	24.0	24.0
Total Split (s)	20.0	20.0	20.0	20.0	24.0	24.0	24.0	24.0
Total Split (%)	45.5%	45.5%	45.5%	45.5%	54.5%	54.5%	54.5%	54.5%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode	None	None	None	None	Min	Min	Min	Min

Intersection Summary

Cycle Length: 44
 Actuated Cycle Length: 33.5
 Natural Cycle: 45
 Control Type: Actuated-Uncoordinated

Splits and Phases: 10: Grand Wailea Resort & Wailea Alanui Dr.



HCM Signalized Intersection Capacity Analysis
 10: Grand Wailea Resort & Wailea Alanui Dr.

Austin, Tsutsumi & Associates, Inc.
 10/19/2009

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations		↕			↕		↗	↗		↗	↗		
Volume (vph)	35	5	15	10	5	50	20	370	25	180	840	100	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)		5.0			5.0		5.0	5.0		5.0	5.0		
Lane Util. Factor		1.00			1.00		1.00	0.95		1.00	0.95		
Flt Protected		0.96			0.90		1.00	0.99		1.00	0.98		
Flt Permitted		0.97			0.99		0.95	1.00		0.95	1.00		
Satd. Flow (prot)		1739			1656		1770	3506		1770	3483		
Satd. Flow (perm)		1795			1555		512	3506		935	3483		
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)	38	5	16	11	5	54	22	402	27	196	913	109	
RTOR Reduction (vph)	0	15	0	0	50	0	0	7	0	0	13	0	
Lane Group Flow (vph)	0	44	0	0	20	0	22	422	0	196	1009	0	
Turn Type	Perm			Perm			Perm			Perm			
Protected Phases		4			8			2			6		
Permitted Phases	4			8			2			6			
Actuated Green, G (s)		2.8			2.8		23.9	23.9		23.9	23.9		
Effective Green, g (s)		2.8			2.8		23.9	23.9		23.9	23.9		
Actuated g/C Ratio		0.08			0.08		0.65	0.65		0.65	0.65		
Clearance Time (s)		5.0			5.0		5.0	5.0		5.0	5.0		
Vehicle Extension (s)		3.0			3.0		3.0	3.0		3.0	3.0		
Lane Grp Cap (vph)		137			119		333	2283		609	2268		
v/s Ratio Prot								0.12			c0.29		
v/s Ratio Perm		c0.02			0.01		0.04			0.21			
v/c Ratio		0.32			0.17		0.07	0.18		0.32	0.44		
Uniform Delay, d1		16.1			15.9		2.3	2.5		2.8	3.1		
Progression Factor		1.00			1.00		1.00	1.00		1.00	1.00		
Incremental Delay, d2		1.4			0.7		0.1	0.0		0.3	0.1		
Delay (s)		17.4			16.5		2.4	2.6		3.1	3.3		
Level of Service		B			B		A	A		A	A		
Approach Delay (s)		17.4			16.5			2.6			3.3		
Approach LOS		B			B			A			A		
Intersection Summary													
HCM Average Control Delay			4.1									HCM Level of Service	A
HCM Volume to Capacity ratio			0.43										
Actuated Cycle Length (s)			36.7									Sum of lost time (s)	10.0
Intersection Capacity Utilization			51.8%									ICU Level of Service	A
Analysis Period (min)			15										
c Critical Lane Group													

HCM Unsignalized Intersection Capacity Analysis
 11: Kaukahi Dr & Wailea Alanui Dr.

Austin, Tsutsumi & Associates, Inc.
 10/19/2009

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	30	20	5	65	30	40	5	245	25	25	440	140
Sign Control		Stop			Stop			Free			Free	
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)	33	22	5	71	33	43	5	266	27	27	478	152
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	826	810	478	826	962	266	630			266		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	826	810	478	826	962	266	630			266		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	87	93	99	74	87	94	99			98		
cM capacity (veh/h)	242	306	587	267	249	772	952			1298		
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2	SB 1	SB 2	SB 3			
Volume Total	33	27	71	76	272	27	27	478	152			
Volume Left	33	0	71	0	5	0	27	0	0			
Volume Right	0	5	0	43	0	27	0	0	152			
cSH	242	338	267	407	952	1700	1298	1700	1700			
Volume to Capacity	0.13	0.08	0.26	0.19	0.01	0.02	0.02	0.28	0.09			
Queue Length 95th (ft)	11	7	26	17	0	0	2	0	0			
Control Delay (s)	22.2	16.6	23.2	15.9	0.2	0.0	7.8	0.0	0.0			
Lane LOS	C	C	C	C	A		A					
Approach Delay (s)	19.6		19.4		0.2		0.3					
Approach LOS	C		C									
Intersection Summary												
Average Delay			3.7									
Intersection Capacity Utilization			40.1%		ICU Level of Service				A			
Analysis Period (min)			15									

Timings
1: Kilohana Dr & Piilani HWY

Austin, Tsutsumi & Associates, Inc.
1/13/2010

Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	175	35	10	30	135	20	1650	15	160	1380	230
Turn Type	Perm		Perm		Perm	Prot		Perm	Prot		Perm
Protected Phases		4		8		5	2		1	6	
Permitted Phases	4		8		8			2			6
Detector Phase	4	4	8	8	8	5	2	2	1	6	6
Switch Phase											
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	12.0	12.0	12.0	12.0	12.0	10.0	24.0	24.0	10.0	24.0	24.0
Total Split (s)	29.0	29.0	29.0	29.0	29.0	10.0	51.0	51.0	20.0	61.0	61.0
Total Split (%)	29.0%	29.0%	29.0%	29.0%	29.0%	10.0%	51.0%	51.0%	20.0%	61.0%	61.0%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	3.0	4.0	4.0	3.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	4.0	5.0	5.0	4.0	5.0	5.0
Lead/Lag						Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?						Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	Min	Max	Max	Min	Max	Max

Intersection Summary
























Cycle Length: 100
 Actuated Cycle Length: 93.7
 Natural Cycle: 80
 Control Type: Actuated-Uncoordinated

Splits and Phases: 1: Kilohana Dr & Piilani HWY



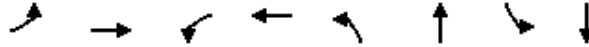
HCM Signalized Intersection Capacity Analysis
 1: Kilohana Dr & Piilani HWY

Austin, Tsutsumi & Associates, Inc.
 1/13/2010

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	175	35	10	10	30	135	20	1650	15	160	1380	230
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0	5.0	4.0	5.0	5.0	4.0	5.0	5.0
Lane Util. Factor	1.00	1.00		1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Flt Protected	1.00	0.97		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	1800		1770	1863	1583	1770	3539	1583	1770	3539	1583
Satd. Flow (perm)	1370	1800		1351	1863	1583	1770	3539	1583	1770	3539	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)	190	38	11	11	33	147	22	1793	16	174	1500	250
RTOR Reduction (vph)	0	9	0	0	0	119	0	0	6	0	0	100
Lane Group Flow (vph)	190	40	0	11	33	28	22	1793	10	174	1500	150
Turn Type	Perm			Perm		Perm	Prot		Perm	Prot		Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8		8			2			6
Actuated Green, G (s)	17.6	17.6		17.6	17.6	17.6	5.9	48.7	48.7	13.4	56.2	56.2
Effective Green, g (s)	17.6	17.6		17.6	17.6	17.6	5.9	48.7	48.7	13.4	56.2	56.2
Actuated g/C Ratio	0.19	0.19		0.19	0.19	0.19	0.06	0.52	0.52	0.14	0.60	0.60
Clearance Time (s)	5.0	5.0		5.0	5.0	5.0	4.0	5.0	5.0	4.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	257	338		254	350	297	111	1839	823	253	2123	949
v/s Ratio Prot		0.02			0.02		0.01	c0.51		c0.10	0.42	
v/s Ratio Perm	c0.14			0.01		0.02			0.01			0.09
v/c Ratio	0.74	0.12		0.04	0.09	0.09	0.20	0.97	0.01	0.69	0.71	0.16
Uniform Delay, d1	35.9	31.6		31.2	31.5	31.5	41.7	21.9	10.9	38.2	13.0	8.3
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	10.6	0.2		0.1	0.1	0.1	0.9	15.8	0.0	7.6	2.0	0.4
Delay (s)	46.5	31.8		31.2	31.6	31.6	42.5	37.8	10.9	45.7	15.0	8.6
Level of Service	D	C		C	C	C	D	D	B	D	B	A
Approach Delay (s)		43.5			31.6			37.6			17.0	
Approach LOS		D			C			D			B	
Intersection Summary												
HCM Average Control Delay			28.2									HCM Level of Service C
HCM Volume to Capacity ratio			0.87									
Actuated Cycle Length (s)			93.7									Sum of lost time (s) 14.0
Intersection Capacity Utilization			82.5%									ICU Level of Service E
Analysis Period (min)			15									
c Critical Lane Group												

Timings
2: Okolani Dr. & Piilani HWY

Austin, Tsutsumi & Associates, Inc.
10/19/2009



Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Volume (vph)	250	35	15	20	40	1330	80	1030
Turn Type	Perm		Perm		Prot		Prot	
Protected Phases		4		8	5	2	1	6
Permitted Phases	4		8					
Detector Phase	4	4	8	8	5	2	1	6
Switch Phase								
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	24.0	24.0	24.0	24.0	10.0	24.0	10.0	24.0
Total Split (s)	34.0	34.0	34.0	34.0	12.0	52.0	14.0	54.0
Total Split (%)	34.0%	34.0%	34.0%	34.0%	12.0%	52.0%	14.0%	54.0%
Yellow Time (s)	4.0	4.0	4.0	4.0	3.0	4.0	3.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	4.0	5.0	4.0	5.0
Lead/Lag					Lead	Lag	Lead	Lag
Lead-Lag Optimize?					Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	Max	None	Max

Intersection Summary




















Cycle Length: 100
 Actuated Cycle Length: 91.5
 Natural Cycle: 70
 Control Type: Actuated-Uncoordinated

Splits and Phases: 2: Okolani Dr. & Piilani HWY



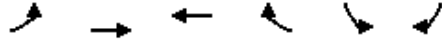
HCM Signalized Intersection Capacity Analysis
2: Okolani Dr. & Piilani HWY

Austin, Tsutsumi & Associates, Inc.
10/19/2009

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	250	35	30	15	20	45	40	1330	40	80	1030	270
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0			5.0		4.0	5.0		4.0	5.0	
Lane Util. Factor	1.00	1.00			1.00		1.00	0.95		1.00	0.95	
Flt Protected	1.00	0.93			0.92		1.00	1.00		1.00	0.97	
Flt Permitted	0.95	1.00			0.99		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1733			1705		1770	3524		1770	3429	
Satd. Flow (perm)	1363	1733			1635		1770	3524		1770	3429	
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)	272	38	33	16	22	49	43	1446	43	87	1120	293
RTOR Reduction (vph)	0	25	0	0	37	0	0	2	0	0	20	0
Lane Group Flow (vph)	272	46	0	0	50	0	43	1487	0	87	1393	0
Turn Type	Perm			Perm			Prot			Prot		
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8								
Actuated Green, G (s)	22.5	22.5			22.5		4.4	49.3		7.3	52.2	
Effective Green, g (s)	22.5	22.5			22.5		4.4	49.3		7.3	52.2	
Actuated g/C Ratio	0.24	0.24			0.24		0.05	0.53		0.08	0.56	
Clearance Time (s)	5.0	5.0			5.0		4.0	5.0		4.0	5.0	
Vehicle Extension (s)	3.0	3.0			3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	329	419			395		84	1866		139	1923	
v/s Ratio Prot		0.03					0.02	0.42		0.05	0.41	
v/s Ratio Perm	0.20			0.03								
v/c Ratio	0.83	0.11			0.13		0.51	0.80		0.63	0.72	
Uniform Delay, d1	33.5	27.5			27.6		43.3	17.8		41.6	15.1	
Progression Factor	1.00	1.00			1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	15.5	0.1			0.1		5.2	3.6		8.5	2.4	
Delay (s)	49.0	27.6			27.8		48.5	21.5		50.1	17.5	
Level of Service	D	C			C		D	C		D	B	
Approach Delay (s)		44.5			27.8			22.2			19.4	
Approach LOS		D			C			C			B	
Intersection Summary												
HCM Average Control Delay			23.4				HCM Level of Service			C		
HCM Volume to Capacity ratio			0.83									
Actuated Cycle Length (s)			93.1				Sum of lost time (s)		19.0			
Intersection Capacity Utilization			74.7%				ICU Level of Service		D			
Analysis Period (min)			15									
c Critical Lane Group												

Timings
3: Wailea Ike Dr. & Piilani HWY

Austin, Tsutsumi & Associates, Inc.
10/19/2009



Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	↖↗	↑	↑	↖↗	↖↗	↖↗
Volume (vph)	1305	80	100	285	255	880
Turn Type	Prot			Perm		Free
Protected Phases	7	4	8		1	
Permitted Phases				8		Free
Detector Phase	7	4	8	8	1	
Switch Phase						
Minimum Initial (s)	4.0	4.0	4.0	4.0	3.0	
Minimum Split (s)	24.0	24.0	24.0	24.0	7.0	
Total Split (s)	55.0	54.0	23.0	23.0	18.0	0.0
Total Split (%)	57.3%	56.3%	24.0%	24.0%	18.8%	0.0%
Yellow Time (s)	3.0	4.0	4.0	4.0	3.0	
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	5.0	5.0	5.0	4.0	4.0
Lead/Lag	Lead		Lag	Lag		
Lead-Lag Optimize?						
Recall Mode	None	None	None	None	None	

Intersection Summary

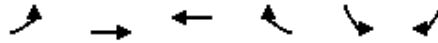
Cycle Length: 96
 Actuated Cycle Length: 75.6
 Natural Cycle: 90
 Control Type: Actuated-Uncoordinated

Splits and Phases: 3: Wailea Ike Dr. & Piilani HWY



HCM Signalized Intersection Capacity Analysis
 3: Wailea Ike Dr. & Piilani HWY

Austin, Tsutsumi & Associates, Inc.
 10/19/2009



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	1305	80	100	285	255	880
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	5.0	5.0	5.0	4.0	4.0
Lane Util. Factor	0.97	1.00	1.00	1.00	1.00	1.00
Flt	1.00	1.00	1.00	0.85	1.00	0.85
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	3433	1863	1863	1583	1770	1583
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	3433	1863	1863	1583	1770	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	1418	87	109	310	277	957
RTOR Reduction (vph)	0	0	0	221	0	0
Lane Group Flow (vph)	1418	87	109	89	277	957
Turn Type	Prot		Perm		Free	
Protected Phases	7	4	8		1	
Permitted Phases				8		Free
Actuated Green, G (s)	37.1	51.9	10.8	10.8	14.4	75.3
Effective Green, g (s)	37.1	51.9	10.8	10.8	14.4	75.3
Actuated g/C Ratio	0.49	0.69	0.14	0.14	0.19	1.00
Clearance Time (s)	4.0	5.0	5.0	5.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	1691	1284	267	227	338	1583
v/s Ratio Prot	c0.41	0.05	0.06		c0.16	
v/s Ratio Perm				0.06		c0.60
v/c Ratio	0.84	0.07	0.41	0.39	0.82	0.60
Uniform Delay, d1	16.5	3.8	29.3	29.3	29.2	0.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	3.8	0.0	1.0	1.1	14.3	1.7
Delay (s)	20.3	3.8	30.4	30.4	43.5	1.7
Level of Service	C	A	C	C	D	A
Approach Delay (s)		19.4	30.4		11.1	
Approach LOS		B	C		B	

Intersection Summary			
HCM Average Control Delay	17.6	HCM Level of Service	B
HCM Volume to Capacity ratio	0.78		
Actuated Cycle Length (s)	75.3	Sum of lost time (s)	8.0
Intersection Capacity Utilization	65.5%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

HCM Unsignalized Intersection Capacity Analysis
 4: Wailea Ike Dr. & Kalai Waa St

Austin, Tsutsumi & Associates, Inc.
 10/19/2009

	→	↘	↙	←	↖	↗	
Movement	EBT	EBR	WBL	WBT	NBL	NBR	
Lane Configurations	↑↑		↘	↑↑	↘	↘	
Volume (veh/h)	1110	75	120	830	65	160	
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)	1207	82	130	902	71	174	
Pedestrians							
Lane Width (ft)							
Walking Speed (ft/s)							
Percent Blockage							
Right turn flare (veh)							
Median type	None		None				
Median storage (veh)							
Upstream signal (ft)	749						
pX, platoon unblocked							
vC, conflicting volume			1288		1959	644	
vC1, stage 1 conf vol							
vC2, stage 2 conf vol							
vCu, unblocked vol			1288		1959	644	
tC, single (s)			4.1		6.8	6.9	
tC, 2 stage (s)							
tF (s)			2.2		3.5	3.3	
p0 queue free %			76		0	58	
cM capacity (veh/h)			534		42	416	
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	WB 3	NB 1	NB 2
Volume Total	804	484	130	451	451	71	174
Volume Left	0	0	130	0	0	71	0
Volume Right	0	82	0	0	0	0	174
cSH	1700	1700	534	1700	1700	42	416
Volume to Capacity	0.47	0.28	0.24	0.27	0.27	1.68	0.42
Queue Length 95th (ft)	0	0	24	0	0	181	51
Control Delay (s)	0.0	0.0	13.9	0.0	0.0	542.1	19.8
Lane LOS			B			F	C
Approach Delay (s)	0.0		1.8		170.6		
Approach LOS					F		
Intersection Summary							
Average Delay			17.0				
Intersection Capacity Utilization			53.3%		ICU Level of Service		A
Analysis Period (min)			15				

Timings
7: Wailea Ike Dr. & Wailea Alanui Dr.

Austin, Tsutsumi & Associates, Inc.
10/19/2009

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	565	240	405	805	255	375
Turn Type		Perm		pt+ov	Prot	
Protected Phases	8		2	2 8	1	6
Permitted Phases		8				
Detector Phase	8	8	2	2 8	1	6
Switch Phase						
Minimum Initial (s)	4.0	4.0	4.0		4.0	4.0
Minimum Split (s)	22.0	22.0	24.0		10.0	24.0
Total Split (s)	29.0	29.0	36.0	65.0	25.0	61.0
Total Split (%)	32.2%	32.2%	40.0%	72.2%	27.8%	67.8%
Yellow Time (s)	3.0	3.0	4.0		3.0	4.0
All-Red Time (s)	1.0	1.0	1.0		1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	4.0	5.0	5.0	4.0	5.0
Lead/Lag			Lag		Lead	
Lead-Lag Optimize?			Yes		Yes	
Recall Mode	None	None	Max		None	Max

Intersection Summary
















Cycle Length: 90
 Actuated Cycle Length: 87.7
 Natural Cycle: 60
 Control Type: Actuated-Uncoordinated

Splits and Phases: 7: Wailea Ike Dr. & Wailea Alanui Dr.

























HCM Signalized Intersection Capacity Analysis
 7: Wailea Ike Dr. & Wailea Alanui Dr.

Austin, Tsutsumi & Associates, Inc.
 10/19/2009

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	 			 		 
Volume (vph)	565	240	405	805	255	375
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	5.0	5.0	4.0	5.0
Lane Util. Factor	0.97	1.00	1.00	0.88	1.00	0.95
Flt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	3433	1583	1863	2787	1770	3539
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	3433	1583	1863	2787	1770	3539
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	614	261	440	875	277	408
RTOR Reduction (vph)	0	194	0	120	0	0
Lane Group Flow (vph)	614	67	440	755	277	408
Turn Type		Perm		pt+ov	Prot	
Protected Phases	8		2	2 8	1	6
Permitted Phases		8				
Actuated Green, G (s)	22.6	22.6	34.4	62.0	17.7	56.1
Effective Green, g (s)	22.6	22.6	34.4	62.0	17.7	56.1
Actuated g/C Ratio	0.26	0.26	0.39	0.71	0.20	0.64
Clearance Time (s)	4.0	4.0	5.0		4.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	885	408	731	1970	357	2264
v/s Ratio Prot	c0.18		c0.24	0.27	c0.16	0.12
v/s Ratio Perm		0.04				
v/c Ratio	0.69	0.16	0.60	0.38	0.78	0.18
Uniform Delay, d1	29.4	25.2	21.2	5.2	33.1	6.4
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	2.4	0.2	3.6	0.1	10.1	0.2
Delay (s)	31.8	25.4	24.9	5.3	43.2	6.6
Level of Service	C	C	C	A	D	A
Approach Delay (s)	29.9		11.8			21.4
Approach LOS	C		B			C
Intersection Summary						
HCM Average Control Delay			19.6		HCM Level of Service	B
HCM Volume to Capacity ratio			0.67			
Actuated Cycle Length (s)			87.7		Sum of lost time (s)	13.0
Intersection Capacity Utilization			62.4%		ICU Level of Service	B
Analysis Period (min)			15			
c Critical Lane Group						











HCM Unsignalized Intersection Capacity Analysis
 8: Okolani Dr & Wailea Alanui Dr.

Austin, Tsutsumi & Associates, Inc.
 10/19/2009

															
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR			
Lane Configurations															
Sign Control	Stop			Stop			Stop			Stop					
Volume (vph)	15	90	430	95	70	15	460	105	145	15	30	15			
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)	16	98	467	103	76	16	500	114	158	16	33	16			
Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	NB 1	NB 2	NB 3	SB 1	SB 2					
Volume Total (vph)	16	98	467	179	16	500	114	158	49	16					
Volume Left (vph)	16	0	0	103	0	500	0	0	16	0					
Volume Right (vph)	0	0	467	0	16	0	0	158	0	16					
Hadj (s)	0.53	0.03	-0.67	0.32	-0.67	0.53	0.03	-0.67	0.20	-0.67					
Departure Headway (s)	7.3	6.8	3.2	6.9	5.9	6.1	5.6	3.2	6.5	5.7					
Degree Utilization, x	0.03	0.18	0.42	0.34	0.03	0.85	0.18	0.14	0.09	0.03					
Capacity (veh/h)	463	499	1115	496	568	580	621	1121	517	588					
Control Delay (s)	9.3	10.1	7.3	12.3	7.9	33.4	8.6	5.5	9.0	7.6					
Approach Delay (s)	7.8				11.9				8.6						
Approach LOS	A			B			C			A					
Intersection Summary															
Delay			16.1												
HCM Level of Service			C												
Intersection Capacity Utilization			54.4%				ICU Level of Service				A				
Analysis Period (min)			15												

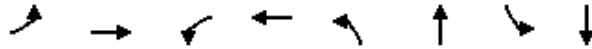
HCM Unsignalized Intersection Capacity Analysis
 9: Kilohana Dr & South Kihei Rd

Austin, Tsutsumi & Associates, Inc.
 10/19/2009

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	35	150	520	25	100	510
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	38	163	565	27	109	554
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)		1				
Median type			None			None
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1351	579			592	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1351	579			592	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	74	68			89	
cM capacity (veh/h)	147	515			983	
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	201	592	663			
Volume Left	38	0	109			
Volume Right	163	27	0			
cSH	635	1700	983			
Volume to Capacity	0.32	0.35	0.11			
Queue Length 95th (ft)	34	0	9			
Control Delay (s)	19.5	0.0	2.7			
Lane LOS	C		A			
Approach Delay (s)	19.5	0.0	2.7			
Approach LOS	C					
Intersection Summary						
Average Delay		3.9				
Intersection Capacity Utilization		74.6%		ICU Level of Service		D
Analysis Period (min)		15				

Timings
10: Grand Wailea Resort & Wailea Alanui Dr.

Austin, Tsutsumi & Associates, Inc.
10/19/2009

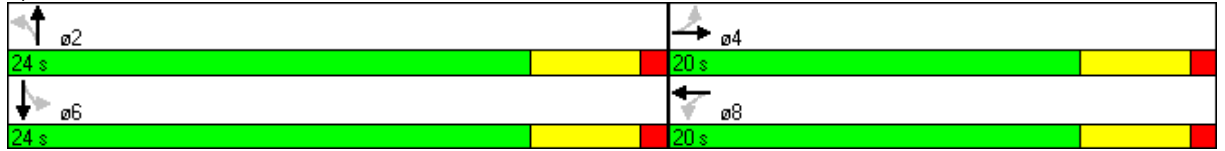


Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations		↕		↕	↗	↕	↗	↕
Volume (vph)	105	5	10	15	30	930	60	635
Turn Type	Perm		Perm		Perm		Perm	
Protected Phases		4		8		2		6
Permitted Phases	4		8		2		6	
Detector Phase	4	4	8	8	2	2	6	6
Switch Phase								
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	20.0	20.0	20.0	24.0	24.0	24.0	24.0
Total Split (s)	20.0	20.0	20.0	20.0	24.0	24.0	24.0	24.0
Total Split (%)	45.5%	45.5%	45.5%	45.5%	54.5%	54.5%	54.5%	54.5%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode	None	None	None	None	Min	Min	Min	Min

Intersection Summary

Cycle Length: 44
 Actuated Cycle Length: 37.4
 Natural Cycle: 45
 Control Type: Actuated-Uncoordinated

Splits and Phases: 10: Grand Wailea Resort & Wailea Alanui Dr.
























HCM Signalized Intersection Capacity Analysis
 10: Grand Wailea Resort & Wailea Alanui Dr.

Austin, Tsutsumi & Associates, Inc.
 10/19/2009

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕		↗	↗		↗	↗	
Volume (vph)	105	5	25	10	15	45	30	930	10	60	635	65
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0			5.0		5.0	5.0		5.0	5.0	
Lane Util. Factor		1.00			1.00		1.00	0.95		1.00	0.95	
Flt Protected		0.98			0.91		1.00	1.00		1.00	0.99	
Flt Permitted		0.96			0.99		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1748			1688		1770	3534		1770	3490	
Satd. Flow (perm)		1313			1582		676	3534		461	3490	
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)	114	5	27	11	16	49	33	1011	11	65	690	71
RTOR Reduction (vph)	0	22	0	0	38	0	0	1	0	0	14	0
Lane Group Flow (vph)	0	124	0	0	38	0	33	1021	0	65	747	0
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)		7.5			7.5		21.1	21.1		21.1	21.1	
Effective Green, g (s)		7.5			7.5		21.1	21.1		21.1	21.1	
Actuated g/C Ratio		0.19			0.19		0.55	0.55		0.55	0.55	
Clearance Time (s)		5.0			5.0		5.0	5.0		5.0	5.0	
Vehicle Extension (s)		3.0			3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		255			307		370	1932		252	1908	
v/s Ratio Prot								c0.29			0.21	
v/s Ratio Perm		c0.09			0.02		0.05			0.14		
v/c Ratio		0.49			0.12		0.09	0.53		0.26	0.39	
Uniform Delay, d1		13.8			12.8		4.2	5.6		4.6	5.0	
Progression Factor		1.00			1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2		1.5			0.2		0.1	0.3		0.5	0.1	
Delay (s)		15.3			13.0		4.3	5.8		5.2	5.2	
Level of Service		B			B		A	A		A	A	
Approach Delay (s)		15.3			13.0			5.8			5.2	
Approach LOS		B			B			A			A	
Intersection Summary												
HCM Average Control Delay			6.5									HCM Level of Service A
HCM Volume to Capacity ratio			0.52									
Actuated Cycle Length (s)			38.6									Sum of lost time (s) 10.0
Intersection Capacity Utilization			56.1%									ICU Level of Service B
Analysis Period (min)			15									
c Critical Lane Group												

HCM Unsignalized Intersection Capacity Analysis
 11: Kaukahi Dr & Wailea Alanui Dr.

Austin, Tsutsumi & Associates, Inc.
 10/19/2009

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	90	25	10	60	15	15	10	590	80	40	495	65
Sign Control		Stop			Stop			Free			Free	
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)	98	27	11	65	16	16	11	641	87	43	538	71
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type												
Median storage veh												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1296	1288	538	1312	1359	641	609			641		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1296	1288	538	1312	1359	641	609			641		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	16	82	98	41	88	97	99			95		
cM capacity (veh/h)	117	155	543	110	140	475	970			943		
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2	SB 1	SB 2	SB 3			
Volume Total	98	38	65	33	652	87	43	538	71			
Volume Left	98	0	65	0	11	0	43	0	0			
Volume Right	0	11	0	16	0	87	0	0	71			
cSH	117	194	110	216	970	1700	943	1700	1700			
Volume to Capacity	0.84	0.20	0.59	0.15	0.01	0.05	0.05	0.32	0.04			
Queue Length 95th (ft)	124	18	72	13	1	0	4	0	0			
Control Delay (s)	112.5	28.0	77.0	24.6	0.3	0.0	9.0	0.0	0.0			
Lane LOS	F	D	F	C	A		A					
Approach Delay (s)	88.8		59.5		0.3		0.6					
Approach LOS	F		F									
Intersection Summary												
Average Delay			11.4									
Intersection Capacity Utilization			57.4%		ICU Level of Service				B			
Analysis Period (min)			15									



APPENDIX C

LEVEL OF SERVICE CALCULATIONS

- Future Year 2018 WITH Project
-

Timings
1: Kilohana Dr & Piilani HWY

Austin, Tsutsumi & Associates, Inc.
1/13/2010

	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	155	20	15	30	155	5	970	5	50	1590	150
Turn Type	Perm		Perm		Perm	Prot		Perm	Prot		Perm
Protected Phases		4		8		5	2		1	6	
Permitted Phases	4		8		8			2			6
Detector Phase	4	4	8	8	8	5	2	2	1	6	6
Switch Phase											
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	12.0	12.0	12.0	12.0	12.0	10.0	24.0	24.0	10.0	24.0	24.0
Total Split (s)	35.0	35.0	35.0	35.0	35.0	10.0	62.0	62.0	23.0	75.0	75.0
Total Split (%)	29.2%	29.2%	29.2%	29.2%	29.2%	8.3%	51.7%	51.7%	19.2%	62.5%	62.5%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	3.0	4.0	4.0	3.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	4.0	5.0	5.0	4.0	5.0	5.0
Lead/Lag						Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?						Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	Min	Max	Max	Min	Max	Max
Act Effct Green (s)	18.5	18.5	18.5	18.5	18.5	5.7	67.2	67.2	8.7	70.2	70.2
Actuated g/C Ratio	0.17	0.17	0.17	0.17	0.17	0.05	0.62	0.62	0.08	0.65	0.65
v/c Ratio	0.72	0.11	0.07	0.10	0.41	0.05	0.48	0.01	0.38	0.75	0.15
Control Delay	59.9	27.9	37.1	37.6	8.9	52.8	13.2	7.0	56.0	16.9	2.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	59.9	27.9	37.1	37.6	8.9	52.8	13.2	7.0	56.0	16.9	2.5
LOS	E	C	D	D	A	D	B	A	E	B	A
Approach Delay		54.7		15.3			13.4			16.8	
Approach LOS		D		B			B			B	

Intersection Summary
























Cycle Length: 120
 Actuated Cycle Length: 108.4
 Natural Cycle: 65
 Control Type: Actuated-Uncoordinated
 Maximum v/c Ratio: 0.75
 Intersection Signal Delay: 17.9
 Intersection LOS: B
 Intersection Capacity Utilization 67.5%
 ICU Level of Service C
 Analysis Period (min) 15

Splits and Phases: 1: Kilohana Dr & Piilani HWY



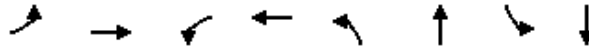
HCM Signalized Intersection Capacity Analysis
1: Kilohana Dr & Piilani HWY

Austin, Tsutsumi & Associates, Inc.
1/13/2010

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	155	20	10	15	30	155	5	970	5	50	1590	150
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0	5.0	4.0	5.0	5.0	4.0	5.0	5.0
Lane Util. Factor	1.00	1.00		1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Flt Protected	1.00	0.95		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	1770		1770	1863	1583	1770	3539	1583	1770	3539	1583
Satd. Flow (perm)	1370	1770		1370	1863	1583	1770	3539	1583	1770	3539	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)	168	22	11	16	33	168	5	1054	5	54	1728	163
RTOR Reduction (vph)	0	9	0	0	0	139	0	0	2	0	0	50
Lane Group Flow (vph)	168	24	0	16	33	29	5	1054	3	54	1728	113
Turn Type	Perm			Perm		Perm	Prot		Perm	Prot		Perm
Protected Phases		4			8		5	2		1		6
Permitted Phases	4			8		8			2			6
Actuated Green, G (s)	18.5	18.5		18.5	18.5	18.5	5.7	67.2	67.2	8.7	70.2	70.2
Effective Green, g (s)	18.5	18.5		18.5	18.5	18.5	5.7	67.2	67.2	8.7	70.2	70.2
Actuated g/C Ratio	0.17	0.17		0.17	0.17	0.17	0.05	0.62	0.62	0.08	0.65	0.65
Clearance Time (s)	5.0	5.0		5.0	5.0	5.0	4.0	5.0	5.0	4.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	234	302		234	318	270	93	2194	981	142	2292	1025
v/s Ratio Prot		0.01			0.02		0.00	0.30		c0.03	c0.49	
v/s Ratio Perm	c0.12			0.01		0.02			0.00			0.07
v/c Ratio	0.72	0.08		0.07	0.10	0.11	0.05	0.48	0.00	0.38	0.75	0.11
Uniform Delay, d1	42.5	37.8		37.7	38.0	38.0	48.8	11.2	7.8	47.3	13.2	7.2
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	10.1	0.1		0.1	0.1	0.2	0.2	0.8	0.0	1.7	2.4	0.2
Delay (s)	52.5	37.9		37.8	38.1	38.1	49.0	11.9	7.9	49.0	15.5	7.5
Level of Service	D	D		D	D	D	D	B	A	D	B	A
Approach Delay (s)		50.1			38.1			12.1			15.8	
Approach LOS		D			D			B			B	
Intersection Summary												
HCM Average Control Delay			18.0									HCM Level of Service B
HCM Volume to Capacity ratio			0.73									
Actuated Cycle Length (s)			108.4									Sum of lost time (s) 14.0
Intersection Capacity Utilization			67.5%									ICU Level of Service C
Analysis Period (min)			15									
c Critical Lane Group												

Timings
2: Okolani Dr. & Piilani HWY

Austin, Tsutsumi & Associates, Inc.
7/31/2009



Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations	↖	↗		↕	↖	↗	↖	↗
Volume (vph)	185	15	35	20	10	725	35	1400
Turn Type	Perm		Perm		Prot		Prot	
Protected Phases		4		8	5	2	1	6
Permitted Phases	4		8					
Detector Phase	4	4	8	8	5	2	1	6
Switch Phase								
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	24.0	24.0	24.0	24.0	10.0	24.0	10.0	24.0
Total Split (s)	27.0	27.0	27.0	27.0	12.0	39.0	14.0	41.0
Total Split (%)	33.8%	33.8%	33.8%	33.8%	15.0%	48.8%	17.5%	51.3%
Yellow Time (s)	4.0	4.0	4.0	4.0	3.0	4.0	3.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	4.0	5.0	4.0	5.0
Lead/Lag					Lead	Lag	Lead	Lag
Lead-Lag Optimize?					Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	Max	None	Max
Act Effct Green (s)	15.7	15.7		15.7	6.1	37.7	7.1	40.2
Actuated g/C Ratio	0.23	0.23		0.23	0.09	0.55	0.10	0.59
v/c Ratio	0.69	0.10		0.32	0.07	0.41	0.21	0.81
Control Delay	36.9	12.4		13.0	32.8	11.8	32.7	17.5
Queue Delay	0.0	0.0		0.0	0.0	0.0	0.0	0.0
Total Delay	36.9	12.4		13.0	32.8	11.8	32.7	17.5
LOS	D	B		B	C	B	C	B
Approach Delay		32.6		13.0		12.1		17.8
Approach LOS		C		B		B		B

Intersection Summary




















Cycle Length: 80
 Actuated Cycle Length: 68
 Natural Cycle: 75
 Control Type: Actuated-Uncoordinated
 Maximum v/c Ratio: 0.81
 Intersection Signal Delay: 17.2
 Intersection LOS: B
 Intersection Capacity Utilization 68.2%
 ICU Level of Service C
 Analysis Period (min) 15

Splits and Phases: 2: Okolani Dr. & Piilani HWY



HCM Signalized Intersection Capacity Analysis
2: Okolani Dr. & Piilani HWY

Austin, Tsutsumi & Associates, Inc.
7/31/2009

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	185	15	25	35	20	70	10	725	15	35	1400	135
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0			5.0		4.0	5.0		4.0	5.0	
Lane Util. Factor	1.00	1.00			1.00		1.00	0.95		1.00	0.95	
Flt Protected	1.00	0.91			0.92		1.00	1.00		1.00	0.99	
Flt Permitted	0.95	1.00			0.99		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1687			1698		1770	3529		1770	3492	
Satd. Flow (perm)	1263	1687			1566		1770	3529		1770	3492	
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	16	27	38	22	76	11	788	16	38	1522	147
RTOR Reduction (vph)	0	21	0	0	59	0	0	1	0	0	7	0
Lane Group Flow (vph)	201	22	0	0	77	0	11	803	0	38	1662	0
Turn Type	Perm		Perm				Prot		Prot			
Protected Phases	4		8				5		2			
Permitted Phases	4		8									
Actuated Green, G (s)	15.7	15.7			15.7		1.2	38.4		3.0	40.2	
Effective Green, g (s)	15.7	15.7			15.7		1.2	38.4		3.0	40.2	
Actuated g/C Ratio	0.22	0.22			0.22		0.02	0.54		0.04	0.57	
Clearance Time (s)	5.0	5.0			5.0		4.0	5.0		4.0	5.0	
Vehicle Extension (s)	3.0	3.0			3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	279	373			346		30	1906		75	1974	
v/s Ratio Prot		0.01					0.01	0.23		c0.02	c0.48	
v/s Ratio Perm	c0.16		0.05									
v/c Ratio	0.72	0.06			0.22		0.37	0.42		0.51	0.84	
Uniform Delay, d1	25.7	21.9			22.7		34.6	9.7		33.3	12.8	
Progression Factor	1.00	1.00			1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	8.8	0.1			0.3		7.4	0.7		5.3	4.6	
Delay (s)	34.5	21.9			23.0		42.0	10.4		38.6	17.4	
Level of Service	C	C			C		D	B		D	B	
Approach Delay (s)	32.3		23.0				10.8		17.9			
Approach LOS	C		C				B		B			
Intersection Summary												
HCM Average Control Delay	17.3		HCM Level of Service				B					
HCM Volume to Capacity ratio	0.75											
Actuated Cycle Length (s)	71.1		Sum of lost time (s)				9.0					
Intersection Capacity Utilization	68.2%		ICU Level of Service				C					
Analysis Period (min)	15											
c Critical Lane Group												

Timings
3: Wailea Ike Dr. & Piilani HWY

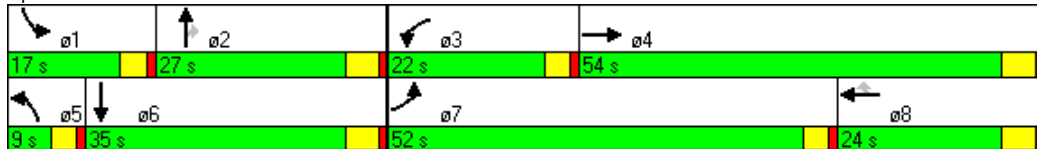
Austin, Tsutsumi & Associates, Inc.
7/31/2009

	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔↔	↔	↔	↔	↔	↔	↕↕	↔	↔↔	↔	↔
Volume (vph)	590	70	5	65	120	20	105	5	130	70	1355
Turn Type	Prot		Prot		Perm	Prot		Perm	Prot		Free
Protected Phases	7	4	3	8		5	2		1	6	
Permitted Phases					8			2			Free
Detector Phase	7	4	3	8	8	5	2	2	1	6	
Switch Phase											
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	3.0	4.0	4.0	3.0	4.0	
Minimum Split (s)	24.0	24.0	24.0	24.0	24.0	7.0	27.0	27.0	7.0	27.0	
Total Split (s)	52.0	54.0	22.0	24.0	24.0	9.0	27.0	27.0	17.0	35.0	0.0
Total Split (%)	43.3%	45.0%	18.3%	20.0%	20.0%	7.5%	22.5%	22.5%	14.2%	29.2%	0.0%
Yellow Time (s)	3.0	4.0	3.0	4.0	4.0	3.0	4.0	4.0	3.0	4.0	
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	5.0	4.0	5.0	5.0	4.0	5.0	5.0	4.0	5.0	4.0
Lead/Lag	Lead	Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	
Lead-Lag Optimize?											
Recall Mode	None	None	Min	None	None	Min	Min	Min	None	Min	
Act Effct Green (s)	17.1	17.7	10.1	8.0	8.0	5.1	7.7	7.7	8.2	10.8	59.4
Actuated g/C Ratio	0.29	0.30	0.17	0.13	0.13	0.09	0.13	0.13	0.14	0.18	1.00
v/c Ratio	0.65	0.16	0.02	0.28	0.40	0.14	0.25	0.02	0.30	0.22	0.93
Control Delay	22.3	14.0	29.0	28.5	10.1	31.8	27.1	18.0	26.8	24.2	13.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	22.3	14.0	29.0	28.5	10.1	31.8	27.1	18.0	26.8	24.2	13.5
LOS	C	B	C	C	B	C	C	B	C	C	B
Approach Delay		21.3		16.9			27.5			15.1	
Approach LOS		C		B			C			B	

Intersection Summary



























Cycle Length: 120
 Actuated Cycle Length: 59.4
 Natural Cycle: 85
 Control Type: Actuated-Uncoordinated
 Maximum v/c Ratio: 0.93
 Intersection Signal Delay: 17.5
 Intersection LOS: B
 Intersection Capacity Utilization 42.2%
 ICU Level of Service A
 Analysis Period (min) 15

Splits and Phases: 3: Wailea Ike Dr. & Piilani HWY



HCM Signalized Intersection Capacity Analysis
 3: Wailea Ike Dr. & Piilani HWY

Austin, Tsutsumi & Associates, Inc.
 7/31/2009

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 							 		 		
Volume (vph)	590	70	10	5	65	120	20	105	5	130	70	1355
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	5.0		4.0	5.0	5.0	4.0	5.0	5.0	4.0	5.0	4.0
Lane Util. Factor	0.97	1.00		1.00	1.00	1.00	1.00	0.95	1.00	0.97	1.00	1.00
Flt Protected	1.00	0.98		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	1827		1770	1863	1583	1770	3539	1583	3433	1863	1583
Satd. Flow (perm)	3433	1827		1770	1863	1583	1770	3539	1583	3433	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)	641	76	11	5	71	130	22	114	5	141	76	1473
RTOR Reduction (vph)	0	5	0	0	0	110	0	0	4	0	0	0
Lane Group Flow (vph)	641	82	0	5	71	20	22	114	1	141	76	1473
Turn Type	Prot			Prot		Perm	Prot		Perm	Prot		Free
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases						8			2			Free
Actuated Green, G (s)	17.1	16.3		10.1	9.3	9.3	5.1	7.7	7.7	8.2	10.8	60.3
Effective Green, g (s)	17.1	16.3		10.1	9.3	9.3	5.1	7.7	7.7	8.2	10.8	60.3
Actuated g/C Ratio	0.28	0.27		0.17	0.15	0.15	0.08	0.13	0.13	0.14	0.18	1.00
Clearance Time (s)	4.0	5.0		4.0	5.0	5.0	4.0	5.0	5.0	4.0	5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	974	494		296	287	244	150	452	202	467	334	1583
v/s Ratio Prot	0.19	0.04		0.00	0.04		0.01	0.03		0.04	0.04	
v/s Ratio Perm						0.01			0.00			c0.93
v/c Ratio	0.66	0.17		0.02	0.25	0.08	0.15	0.25	0.00	0.30	0.23	0.93
Uniform Delay, d1	19.0	16.8		21.0	22.4	21.8	25.6	23.7	23.0	23.5	21.2	0.0
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.6	0.2		0.0	0.5	0.1	0.5	0.3	0.0	0.4	0.3	11.2
Delay (s)	20.6	17.0		21.0	22.9	22.0	26.0	24.0	23.0	23.8	21.5	11.2
Level of Service	C	B		C	C	C	C	C	C	C	C	B
Approach Delay (s)		20.2			22.3			24.3			12.7	
Approach LOS		C			C			C			B	
Intersection Summary												
HCM Average Control Delay			16.0									HCM Level of Service B
HCM Volume to Capacity ratio			0.93									
Actuated Cycle Length (s)			60.3									Sum of lost time (s) 0.0
Intersection Capacity Utilization			42.2%									ICU Level of Service A
Analysis Period (min)			15									
c Critical Lane Group												

HCM Unsignalized Intersection Capacity Analysis
 4: Wailea Ike Dr. & Kalai Waa St

Austin, Tsutsumi & Associates, Inc.
 7/31/2009

	→	↘	↙	←	↖	↗	
Movement	EBT	EBR	WBL	WBT	NBL	NBR	
Lane Configurations	↑↑		↘	↑↑	↘	↗	
Volume (veh/h)	490	60	255	1155	50	120	
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)	533	65	277	1255	54	130	
Pedestrians							
Lane Width (ft)							
Walking Speed (ft/s)							
Percent Blockage							
Right turn flare (veh)							
Median type	None		None				
Median storage (veh)							
Upstream signal (ft)	749						
pX, platoon unblocked							
vC, conflicting volume			598		1747	299	
vC1, stage 1 conf vol							
vC2, stage 2 conf vol							
vCu, unblocked vol			598		1747	299	
tC, single (s)			4.1		6.8	6.9	
tC, 2 stage (s)							
tF (s)			2.2		3.5	3.3	
p0 queue free %			72		2	81	
cM capacity (veh/h)			975		55	697	
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	WB 3	NB 1	NB 2
Volume Total	355	243	277	628	628	54	130
Volume Left	0	0	277	0	0	54	0
Volume Right	0	65	0	0	0	0	130
cSH	1700	1700	975	1700	1700	55	697
Volume to Capacity	0.21	0.14	0.28	0.37	0.37	0.98	0.19
Queue Length 95th (ft)	0	0	29	0	0	112	17
Control Delay (s)	0.0	0.0	10.2	0.0	0.0	236.6	11.3
Lane LOS			B			F	B
Approach Delay (s)	0.0		1.8			77.6	
Approach LOS						F	
Intersection Summary							
Average Delay			7.4				
Intersection Capacity Utilization			42.9%	ICU Level of Service	A		
Analysis Period (min)			15				

Timings
7: Wailea Ike Dr. & Wailea Alanui Dr.

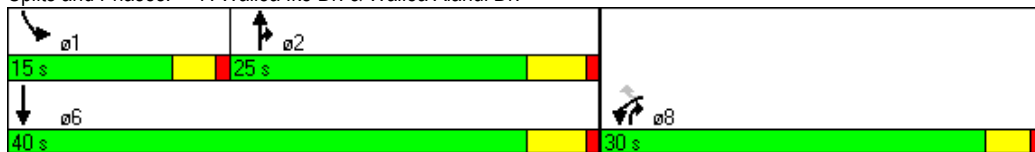
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	↙	↖	↑	↗	↘	↓
Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↙↙	↖	↑	↗↗	↘	↘↘
Volume (vph)	905	215	180	350	190	430
Turn Type		Perm		pt+ov	Prot	
Protected Phases	8		2	2 8	1	6
Permitted Phases		8				
Detector Phase	8	8	2	2 8	1	6
Switch Phase						
Minimum Initial (s)	4.0	4.0	4.0		4.0	4.0
Minimum Split (s)	22.0	22.0	24.0		10.0	24.0
Total Split (s)	30.0	30.0	25.0	55.0	15.0	40.0
Total Split (%)	42.9%	42.9%	35.7%	78.6%	21.4%	57.1%
Yellow Time (s)	3.0	3.0	4.0		3.0	4.0
All-Red Time (s)	1.0	1.0	1.0		1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	4.0	5.0	5.0	4.0	5.0
Lead/Lag			Lag		Lead	
Lead-Lag Optimize?			Yes		Yes	
Recall Mode	None	None	Max		None	Max
Act Effct Green (s)	24.0	24.0	20.6	48.6	10.5	35.1
Actuated g/C Ratio	0.35	0.35	0.30	0.71	0.15	0.52
v/c Ratio	0.81	0.33	0.35	0.18	0.76	0.26
Control Delay	26.2	3.8	21.7	0.8	47.9	10.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	26.2	3.8	21.7	0.8	47.9	10.1
LOS	C	A	C	A	D	B
Approach Delay	21.9		7.9			21.7
Approach LOS	C		A			C

Intersection Summary
















Cycle Length: 70
 Actuated Cycle Length: 68.1
 Natural Cycle: 60
 Control Type: Actuated-Uncoordinated
 Maximum v/c Ratio: 0.81
 Intersection Signal Delay: 18.6
 Intersection LOS: B
 Intersection Capacity Utilization 56.7%
 ICU Level of Service B
 Analysis Period (min) 15

Splits and Phases: 7: Wailea Ike Dr. & Wailea Alanui Dr.

























HCM Signalized Intersection Capacity Analysis
 7: Wailea Ike Dr. & Wailea Alanui Dr.

Austin, Tsutsumi & Associates, Inc.
 7/31/2009

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	 			 		 
Volume (vph)	905	215	180	350	190	430
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	5.0	5.0	4.0	5.0
Lane Util. Factor	0.97	1.00	1.00	0.88	1.00	0.95
Fr _t	1.00	0.85	1.00	0.85	1.00	1.00
Fl _t Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	3433	1583	1863	2787	1770	3539
Fl _t Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	3433	1583	1863	2787	1770	3539
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	984	234	196	380	207	467
RTOR Reduction (vph)	0	152	0	93	0	0
Lane Group Flow (vph)	984	82	196	287	207	467
Turn Type		Perm		pt+ov	Prot	
Protected Phases	8		2	2 8	1	6
Permitted Phases		8				
Actuated Green, G (s)	24.0	24.0	20.6	49.6	10.5	35.1
Effective Green, g (s)	24.0	24.0	20.6	49.6	10.5	35.1
Actuated g/C Ratio	0.35	0.35	0.30	0.73	0.15	0.52
Clearance Time (s)	4.0	4.0	5.0		4.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	1210	558	564	2030	273	1824
v/s Ratio Prot	c0.29		c0.11	0.10	c0.12	0.13
v/s Ratio Perm		0.05				
v/c Ratio	0.81	0.15	0.35	0.14	0.76	0.26
Uniform Delay, d ₁	20.0	15.1	18.5	2.8	27.6	9.2
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d ₂	4.3	0.1	1.7	0.0	11.4	0.3
Delay (s)	24.3	15.2	20.2	2.8	39.0	9.6
Level of Service	C	B	C	A	D	A
Approach Delay (s)	22.6		8.7			18.6
Approach LOS	C		A			B
Intersection Summary						
HCM Average Control Delay			18.2		HCM Level of Service	B
HCM Volume to Capacity ratio			0.63			
Actuated Cycle Length (s)			68.1		Sum of lost time (s)	13.0
Intersection Capacity Utilization			56.7%		ICU Level of Service	B
Analysis Period (min)			15			
c Critical Lane Group						











HCM Unsignalized Intersection Capacity Analysis
 8: Okolani Dr & Wailea Alanui Dr.

Austin, Tsutsumi & Associates, Inc.
 7/31/2009

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control	Stop			Stop			Stop			Stop		
Volume (vph)	10	50	495	105	65	5	240	30	60	10	70	10
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	54	538	114	71	5	261	33	65	11	76	11
Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	NB 1	NB 2	NB 3	SB 1	SB 2		
Volume Total (vph)	11	54	538	185	5	261	33	65	87	11		
Volume Left (vph)	11	0	0	114	0	261	0	0	11	0		
Volume Right (vph)	0	0	538	0	5	0	0	65	0	11		
Hadj (s)	0.53	0.03	-0.67	0.34	-0.67	0.53	0.03	-0.67	0.10	-0.67		
Departure Headway (s)	6.4	5.9	3.2	6.0	5.0	5.9	5.4	3.2	5.7	4.9		
Degree Utilization, x	0.02	0.09	0.48	0.31	0.01	0.43	0.05	0.06	0.14	0.01		
Capacity (veh/h)	524	570	1116	572	673	593	638	1121	600	684		
Control Delay (s)	8.3	8.2	7.9	10.4	6.8	12.0	7.5	5.2	8.4	6.8		
Approach Delay (s)	7.9			10.3			10.3			8.2		
Approach LOS	A			B			B			A		
Intersection Summary												
Delay	9.0											
HCM Level of Service	A											
Intersection Capacity Utilization	54.1%			ICU Level of Service			A					
Analysis Period (min)	15											

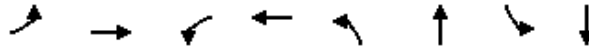
HCM Unsignalized Intersection Capacity Analysis
 9: Kilohana Dr & South Kihei Rd

Austin, Tsutsumi & Associates, Inc.
 7/31/2009

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	10	95	290	10	95	535
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	11	103	315	11	103	582
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)		1				
Median type			None			None
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1109	321			326	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1109	321			326	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	95	86			92	
cM capacity (veh/h)	213	720			1234	
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	114	326	685			
Volume Left	11	0	103			
Volume Right	103	11	0			
cSH	796	1700	1234			
Volume to Capacity	0.14	0.19	0.08			
Queue Length 95th (ft)	12	0	7			
Control Delay (s)	12.0	0.0	2.1			
Lane LOS	B		A			
Approach Delay (s)	12.0	0.0	2.1			
Approach LOS	B					
Intersection Summary						
Average Delay		2.5				
Intersection Capacity Utilization		62.6%		ICU Level of Service		B
Analysis Period (min)		15				

Timings
10: Grand Wailea Resort & Wailea Alanui Dr.

Austin, Tsutsumi & Associates, Inc.
7/31/2009

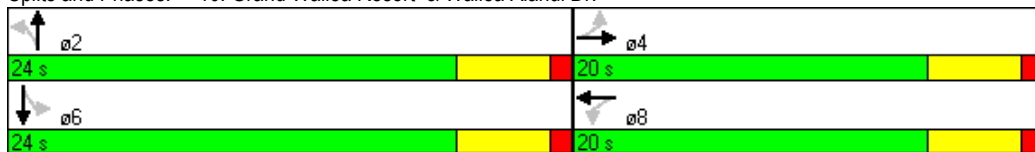


Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations		↕		↕	↖	↗	↖	↗
Volume (vph)	35	5	10	5	20	400	180	890
Turn Type	Perm		Perm		Perm		Perm	
Protected Phases		4		8		2		6
Permitted Phases	4		8		2		6	
Detector Phase	4	4	8	8	2	2	6	6
Switch Phase								
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	20.0	20.0	20.0	24.0	24.0	24.0	24.0
Total Split (s)	20.0	20.0	20.0	20.0	24.0	24.0	24.0	24.0
Total Split (%)	45.5%	45.5%	45.5%	45.5%	54.5%	54.5%	54.5%	54.5%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode	None	None	None	None	Min	Min	Min	Min
Act Effct Green (s)		6.7		6.5	27.2	27.2	27.2	27.2
Actuated g/C Ratio		0.20		0.19	0.81	0.81	0.81	0.81
v/c Ratio		0.16		0.20	0.06	0.16	0.27	0.38
Control Delay		10.7		7.5	4.6	3.0	5.3	3.9
Queue Delay		0.0		0.0	0.0	0.0	0.0	0.0
Total Delay		10.7		7.5	4.6	3.0	5.3	3.9
LOS		B		A	A	A	A	A
Approach Delay		10.7		7.5		3.1		4.1
Approach LOS		B		A		A		A

Intersection Summary













Cycle Length: 44
 Actuated Cycle Length: 33.6
 Natural Cycle: 45
 Control Type: Actuated-Uncoordinated
 Maximum v/c Ratio: 0.38
 Intersection Signal Delay: 4.2
 Intersection LOS: A
 Intersection Capacity Utilization 53.2%
 ICU Level of Service A
 Analysis Period (min) 15

Splits and Phases: 10: Grand Wailea Resort & Wailea Alanui Dr.
























HCM Signalized Intersection Capacity Analysis
 10: Grand Wailea Resort & Wailea Alanui Dr.

Austin, Tsutsumi & Associates, Inc.
 7/31/2009

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕		↗	↗		↗	↗	
Volume (vph)	35	5	15	10	5	50	20	400	25	180	890	100
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0			5.0		5.0	5.0		5.0	5.0	
Lane Util. Factor		1.00			1.00		1.00	0.95		1.00	0.95	
Flt Protected		0.96			0.90		1.00	0.99		1.00	0.98	
Flt Permitted		0.97			0.99		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1739			1656		1770	3508		1770	3485	
Satd. Flow (perm)		1795			1555		477	3508		906	3485	
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)	38	5	16	11	5	54	22	435	27	196	967	109
RTOR Reduction (vph)	0	15	0	0	50	0	0	6	0	0	12	0
Lane Group Flow (vph)	0	44	0	0	20	0	22	456	0	196	1064	0
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)		2.8			2.8		24.0	24.0		24.0	24.0	
Effective Green, g (s)		2.8			2.8		24.0	24.0		24.0	24.0	
Actuated g/C Ratio		0.08			0.08		0.65	0.65		0.65	0.65	
Clearance Time (s)		5.0			5.0		5.0	5.0		5.0	5.0	
Vehicle Extension (s)		3.0			3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		137			118		311	2288		591	2273	
v/s Ratio Prot								0.13			c0.31	
v/s Ratio Perm		c0.02			0.01		0.05			0.22		
v/c Ratio		0.32			0.17		0.07	0.20		0.33	0.47	
Uniform Delay, d1		16.1			15.9		2.3	2.6		2.8	3.2	
Progression Factor		1.00			1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2		1.4			0.7		0.1	0.0		0.3	0.2	
Delay (s)		17.5			16.6		2.4	2.6		3.2	3.4	
Level of Service		B			B		A	A		A	A	
Approach Delay (s)		17.5			16.6			2.6			3.3	
Approach LOS		B			B			A			A	
Intersection Summary												
HCM Average Control Delay			4.1				HCM Level of Service			A		
HCM Volume to Capacity ratio			0.45									
Actuated Cycle Length (s)			36.8				Sum of lost time (s)		10.0			
Intersection Capacity Utilization			53.2%				ICU Level of Service		A			
Analysis Period (min)			15									
c Critical Lane Group												

HCM Unsignalized Intersection Capacity Analysis
 11: Kaukahi Dr & Wailea Alanui Dr.

Austin, Tsutsumi & Associates, Inc.
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Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	30	20	5	90	30	35	5	275	50	20	485	140
Sign Control		Stop			Stop			Free			Free	
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)	33	22	5	98	33	38	5	299	54	22	527	152
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type												
Median storage veh												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	897	880	527	897	1033	299	679			299		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	897	880	527	897	1033	299	679			299		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	85	92	99	59	86	95	99			98		
cM capacity (veh/h)	216	279	551	239	227	741	913			1262		
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2	SB 1	SB 2	SB 3			
Volume Total	33	27	65	103	304	54	22	527	152			
Volume Left	33	0	65	33	5	0	22	0	0			
Volume Right	0	5	0	38	0	54	0	0	152			
cSH	216	310	239	311	913	1700	1262	1700	1700			
Volume to Capacity	0.15	0.09	0.27	0.33	0.01	0.03	0.02	0.31	0.09			
Queue Length 95th (ft)	13	7	27	35	0	0	1	0	0			
Control Delay (s)	24.6	17.7	25.7	22.2	0.2	0.0	7.9	0.0	0.0			
Lane LOS	C	C	D	C	A		A					
Approach Delay (s)	21.5		23.5		0.2		0.2					
Approach LOS	C		C									
Intersection Summary												
Average Delay			4.3									
Intersection Capacity Utilization			43.2%		ICU Level of Service				A			
Analysis Period (min)			15									

Timings
1: Kilohana Dr & Piilani HWY

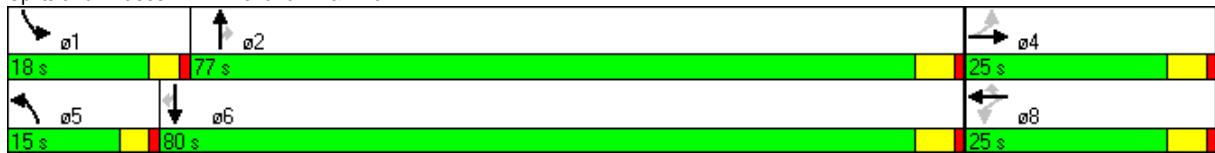
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	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	175	35	10	30	140	20	1855	15	160	1540	230
Turn Type	Perm		Perm		Perm	Prot		Perm	Prot		Perm
Protected Phases		4		8		5	2		1	6	
Permitted Phases	4		8		8			2			6
Detector Phase	4	4	8	8	8	5	2	2	1	6	6
Switch Phase											
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	12.0	12.0	12.0	12.0	12.0	10.0	24.0	24.0	10.0	24.0	24.0
Total Split (s)	25.0	25.0	25.0	25.0	25.0	15.0	77.0	77.0	18.0	80.0	80.0
Total Split (%)	20.8%	20.8%	20.8%	20.8%	20.8%	12.5%	64.2%	64.2%	15.0%	66.7%	66.7%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	3.0	4.0	4.0	3.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	4.0	5.0	5.0	4.0	5.0	5.0
Lead/Lag						Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?						Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	Min	Max	Max	Min	Max	Max

Intersection Summary

Cycle Length: 120
 Actuated Cycle Length: 118.5
 Natural Cycle: 90
 Control Type: Actuated-Uncoordinated

Splits and Phases: 1: Kilohana Dr & Piilani HWY



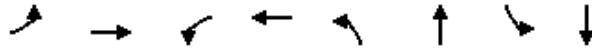
HCM Signalized Intersection Capacity Analysis
1: Kilohana Dr & Piilani HWY

Austin, Tsutsumi & Associates, Inc.
1/13/2010

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	175	35	10	10	30	140	20	1855	15	160	1540	230
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0	5.0	4.0	5.0	5.0	4.0	5.0	5.0
Lane Util. Factor	1.00	1.00		1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Flt Protected	1.00	0.97		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	1800		1770	1863	1583	1770	3539	1583	1770	3539	1583
Satd. Flow (perm)	1370	1800		1351	1863	1583	1770	3539	1583	1770	3539	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)	190	38	11	11	33	152	22	2016	16	174	1674	250
RTOR Reduction (vph)	0	8	0	0	0	128	0	0	5	0	0	84
Lane Group Flow (vph)	190	41	0	11	33	24	22	2016	11	174	1674	166
Turn Type	Perm			Perm		Perm	Prot		Perm	Prot		Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8		8			2			6
Actuated Green, G (s)	18.9	18.9		18.9	18.9	18.9	7.0	72.0	72.0	13.6	78.6	78.6
Effective Green, g (s)	18.9	18.9		18.9	18.9	18.9	7.0	72.0	72.0	13.6	78.6	78.6
Actuated g/C Ratio	0.16	0.16		0.16	0.16	0.16	0.06	0.61	0.61	0.11	0.66	0.66
Clearance Time (s)	5.0	5.0		5.0	5.0	5.0	4.0	5.0	5.0	4.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	219	287		215	297	252	105	2150	962	203	2347	1050
v/s Ratio Prot		0.02			0.02		0.01	c0.57		c0.10	0.47	
v/s Ratio Perm	c0.14			0.01		0.02			0.01			0.10
v/c Ratio	0.87	0.14		0.05	0.11	0.10	0.21	0.94	0.01	0.86	0.71	0.16
Uniform Delay, d1	48.6	42.8		42.2	42.6	42.5	53.1	21.2	9.2	51.5	12.7	7.5
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	28.3	0.2		0.1	0.2	0.2	1.0	9.4	0.0	28.1	1.9	0.3
Delay (s)	76.9	43.1		42.3	42.8	42.7	54.1	30.6	9.2	79.6	14.6	7.8
Level of Service	E	D		D	D	D	D	C	A	E	B	A
Approach Delay (s)		70.0			42.7			30.7			19.2	
Approach LOS		E			D			C			B	
Intersection Summary												
HCM Average Control Delay			28.0									HCM Level of Service C
HCM Volume to Capacity ratio			0.91									
Actuated Cycle Length (s)			118.5								14.0	Sum of lost time (s)
Intersection Capacity Utilization			88.2%									ICU Level of Service E
Analysis Period (min)			15									
c Critical Lane Group												

Timings
2: Okolani Dr. & Piilani HWY

Austin, Tsutsumi & Associates, Inc.
7/31/2009



Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations	↶	↷		↷	↶	↷	↶	↷
Volume (vph)	250	35	15	20	40	1535	80	1190
Turn Type	Perm		Perm		Prot		Prot	
Protected Phases		4		8	5	2	1	6
Permitted Phases	4		8					
Detector Phase	4	4	8	8	5	2	1	6
Switch Phase								
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	24.0	24.0	24.0	24.0	10.0	24.0	10.0	24.0
Total Split (s)	34.0	34.0	34.0	34.0	12.0	52.0	14.0	54.0
Total Split (%)	34.0%	34.0%	34.0%	34.0%	12.0%	52.0%	14.0%	54.0%
Yellow Time (s)	4.0	4.0	4.0	4.0	3.0	4.0	3.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	4.0	5.0	4.0	5.0
Lead/Lag					Lead	Lag	Lead	Lag
Lead-Lag Optimize?					Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	Max	None	Max
Act Effct Green (s)	22.7	22.7		22.7	7.1	48.5	8.8	52.2
Actuated g/C Ratio	0.25	0.25		0.25	0.08	0.53	0.10	0.57
v/c Ratio	0.82	0.16		0.21	0.31	0.92	0.51	0.80
Control Delay	52.8	17.3		14.5	49.1	32.0	52.9	22.3
Queue Delay	0.0	0.0		0.0	0.0	0.0	0.0	0.0
Total Delay	52.8	17.3		14.5	49.1	32.0	52.9	22.3
LOS	D	B		B	D	C	D	C
Approach Delay		45.4		14.5		32.4		23.9
Approach LOS		D		B		C		C

Intersection Summary




















Cycle Length: 100
 Actuated Cycle Length: 91.7
 Natural Cycle: 80
 Control Type: Actuated-Uncoordinated
 Maximum v/c Ratio: 0.92
 Intersection Signal Delay: 29.4
 Intersection LOS: C
 Intersection Capacity Utilization 80.3%
 ICU Level of Service D
 Analysis Period (min) 15

Splits and Phases: 2: Okolani Dr. & Piilani HWY



HCM Signalized Intersection Capacity Analysis
2: Okolani Dr. & Piilani HWY

Austin, Tsutsumi & Associates, Inc.
7/31/2009

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	250	35	30	15	20	50	40	1535	40	80	1190	270
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0			5.0		4.0	5.0		4.0	5.0	
Lane Util. Factor	1.00	1.00			1.00		1.00	0.95		1.00	0.95	
Flt Protected	1.00	0.93			0.92		1.00	1.00		1.00	0.97	
Flt Permitted	0.95	1.00			0.99		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1733			1700		1770	3526		1770	3441	
Satd. Flow (perm)	1342	1733			1634		1770	3526		1770	3441	
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)	272	38	33	16	22	54	43	1668	43	87	1293	293
RTOR Reduction (vph)	0	25	0	0	41	0	0	1	0	0	17	0
Lane Group Flow (vph)	272	46	0	0	51	0	43	1710	0	87	1569	0
Turn Type	Perm			Perm			Prot			Prot		
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8								
Actuated Green, G (s)	22.7	22.7			22.7		4.4	49.3		7.3	52.2	
Effective Green, g (s)	22.7	22.7			22.7		4.4	49.3		7.3	52.2	
Actuated g/C Ratio	0.24	0.24			0.24		0.05	0.53		0.08	0.56	
Clearance Time (s)	5.0	5.0			5.0		4.0	5.0		4.0	5.0	
Vehicle Extension (s)	3.0	3.0			3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	327	422			398		83	1863		138	1925	
v/s Ratio Prot		0.03					0.02	c0.48		c0.05	c0.46	
v/s Ratio Perm	c0.20				0.03							
v/c Ratio	0.83	0.11			0.13		0.52	0.92		0.63	0.82	
Uniform Delay, d1	33.5	27.4			27.6		43.4	20.1		41.7	16.6	
Progression Factor	1.00	1.00			1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	16.3	0.1			0.1		5.4	8.7		9.0	3.9	
Delay (s)	49.8	27.6			27.7		48.8	28.9		50.7	20.6	
Level of Service	D	C			C		D	C		D	C	
Approach Delay (s)		45.2			27.7			29.3			22.1	
Approach LOS		D			C			C			C	
Intersection Summary												
HCM Average Control Delay			27.6				HCM Level of Service			C		
HCM Volume to Capacity ratio			0.92									
Actuated Cycle Length (s)			93.3				Sum of lost time (s)			19.0		
Intersection Capacity Utilization			80.3%				ICU Level of Service			D		
Analysis Period (min)			15									
c Critical Lane Group												

Timings
3: Wailea Ike Dr. & Piilani HWY

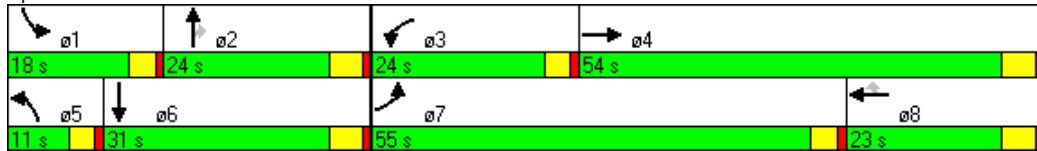
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7/31/2009

	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	1455	105	5	115	245	15	105	5	225	130	945
Turn Type	Prot		Prot		Perm	Prot		Perm	Prot		Free
Protected Phases	7	4	3	8		5	2		1	6	
Permitted Phases					8			2			Free
Detector Phase	7	4	3	8	8	5	2	2	1	6	
Switch Phase											
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	3.0	4.0	4.0	3.0	4.0	
Minimum Split (s)	24.0	24.0	24.0	24.0	24.0	7.0	27.0	27.0	7.0	27.0	
Total Split (s)	55.0	54.0	24.0	23.0	23.0	11.0	24.0	24.0	18.0	31.0	0.0
Total Split (%)	45.8%	45.0%	20.0%	19.2%	19.2%	9.2%	20.0%	20.0%	15.0%	25.8%	0.0%
Yellow Time (s)	3.0	4.0	3.0	4.0	4.0	3.0	4.0	4.0	3.0	4.0	
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	5.0	4.0	5.0	5.0	4.0	5.0	5.0	4.0	5.0	4.0
Lead/Lag	Lead	Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	
Lead-Lag Optimize?											
Recall Mode	None	None	Min	None	None	Min	Min	Min	None	Min	
Act Effct Green (s)	51.2	47.2	18.9	12.3	12.3	6.3	8.7	8.7	12.0	14.5	102.4
Actuated g/C Ratio	0.50	0.46	0.18	0.12	0.12	0.06	0.08	0.08	0.12	0.14	1.00
v/c Ratio	0.92	0.16	0.02	0.56	0.64	0.15	0.38	0.04	0.61	0.54	0.65
Control Delay	35.2	12.5	49.0	52.9	14.0	51.4	49.1	28.0	50.6	49.4	2.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	35.2	12.5	49.0	52.9	14.0	51.4	49.1	28.0	50.6	49.4	2.1
LOS	D	B	D	D	B	D	D	C	D	D	A
Approach Delay		33.4		26.8			48.6			15.2	
Approach LOS		C		C			D			B	

Intersection Summary




























Cycle Length: 120
 Actuated Cycle Length: 102.4
 Natural Cycle: 115
 Control Type: Actuated-Uncoordinated
 Maximum v/c Ratio: 0.92
 Intersection Signal Delay: 26.2
 Intersection LOS: C
 Intersection Capacity Utilization 71.7%
 ICU Level of Service C
 Analysis Period (min) 15

Splits and Phases: 3: Wailea Ike Dr. & Piilani HWY



HCM Signalized Intersection Capacity Analysis
 3: Wailea Ike Dr. & Piilani HWY

Austin, Tsutsumi & Associates, Inc.
 7/31/2009

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 					 		 		 		
Volume (vph)	1455	105	20	5	115	245	15	105	5	225	130	945
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	5.0		4.0	5.0	5.0	4.0	5.0	5.0	4.0	5.0	4.0
Lane Util. Factor	0.97	1.00		1.00	1.00	1.00	1.00	0.95	1.00	0.97	1.00	1.00
Flt Protected	1.00	0.98		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	1818		1770	1863	1583	1770	3539	1583	3433	1863	1583
Satd. Flow (perm)	3433	1818		1770	1863	1583	1770	3539	1583	3433	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)	1582	114	22	5	125	266	16	114	5	245	141	1027
RTOR Reduction (vph)	0	6	0	0	0	222	0	0	5	0	0	0
Lane Group Flow (vph)	1582	130	0	5	125	44	16	114	0	245	141	1027
Turn Type	Prot			Prot		Perm	Prot		Perm	Prot		Free
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases						8			2			Free
Actuated Green, G (s)	51.2	45.8		18.9	13.5	13.5	6.3	8.8	8.8	12.0	14.5	103.5
Effective Green, g (s)	51.2	45.8		18.9	13.5	13.5	6.3	8.8	8.8	12.0	14.5	103.5
Actuated g/C Ratio	0.49	0.44		0.18	0.13	0.13	0.06	0.09	0.09	0.12	0.14	1.00
Clearance Time (s)	4.0	5.0		4.0	5.0	5.0	4.0	5.0	5.0	4.0	5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	1698	804		323	243	206	108	301	135	398	261	1583
v/s Ratio Prot	c0.46	0.07		0.00	0.07		0.01	0.03		0.07	0.08	
v/s Ratio Perm						0.03			0.00			c0.65
v/c Ratio	0.93	0.16		0.02	0.51	0.21	0.15	0.38	0.00	0.62	0.54	0.65
Uniform Delay, d1	24.5	17.3		34.7	41.9	40.3	46.1	44.8	43.3	43.6	41.4	0.0
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	9.7	0.1		0.0	1.8	0.5	0.6	0.8	0.0	2.8	2.3	2.1
Delay (s)	34.3	17.4		34.7	43.8	40.8	46.7	45.6	43.3	46.4	43.7	2.1
Level of Service	C	B		C	D	D	D	D	D	D	D	A
Approach Delay (s)		32.9			41.7			45.6			13.9	
Approach LOS		C			D			D			B	
Intersection Summary												
HCM Average Control Delay			27.0									HCM Level of Service C
HCM Volume to Capacity ratio			0.79									
Actuated Cycle Length (s)			103.5									Sum of lost time (s) 4.0
Intersection Capacity Utilization			71.7%									ICU Level of Service C
Analysis Period (min)			15									
c Critical Lane Group												













HCM Unsignalized Intersection Capacity Analysis
 4: Wailea Ike Dr. & Kalai Waa St

Austin, Tsutsumi & Associates, Inc.
 7/31/2009

	→	↘	↙	←	↖	↗	
Movement	EBT	EBR	WBL	WBT	NBL	NBR	
Lane Configurations	↑↑		↘	↑↑	↘	↘	
Volume (veh/h)	1170	90	160	850	100	285	
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)	1272	98	174	924	109	310	
Pedestrians							
Lane Width (ft)							
Walking Speed (ft/s)							
Percent Blockage							
Right turn flare (veh)							
Median type	None		None				
Median storage (veh)							
Upstream signal (ft)	749						
pX, platoon unblocked							
vC, conflicting volume			1370		2130	685	
vC1, stage 1 conf vol							
vC2, stage 2 conf vol							
vCu, unblocked vol			1370		2130	685	
tC, single (s)			4.1		6.8	6.9	
tC, 2 stage (s)							
tF (s)			2.2		3.5	3.3	
p0 queue free %			65		0	21	
cM capacity (veh/h)			497		28	391	
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	WB 3	NB 1	NB 2
Volume Total	848	522	174	462	462	109	310
Volume Left	0	0	174	0	0	109	0
Volume Right	0	98	0	0	0	0	310
cSH	1700	1700	497	1700	1700	28	391
Volume to Capacity	0.50	0.31	0.35	0.27	0.27	3.93	0.79
Queue Length 95th (ft)	0	0	39	0	0	Err	171
Control Delay (s)	0.0	0.0	16.1	0.0	0.0	Err	41.5
Lane LOS			C			F	E
Approach Delay (s)	0.0		2.5			2627.9	
Approach LOS						F	
Intersection Summary							
Average Delay			382.0				
Intersection Capacity Utilization			59.6%	ICU Level of Service	B		
Analysis Period (min)			15				

Timings
7: Wailea Ike Dr. & Wailea Alanui Dr.

Austin, Tsutsumi & Associates, Inc.
7/31/2009

						
Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	605	290	410	855	285	380
Turn Type		Perm		pt+ov	Prot	
Protected Phases	8		2	2 8	1	6
Permitted Phases		8				
Detector Phase	8	8	2	2 8	1	6
Switch Phase						
Minimum Initial (s)	4.0	4.0	4.0		4.0	4.0
Minimum Split (s)	22.0	22.0	24.0		10.0	24.0
Total Split (s)	29.0	29.0	36.0	65.0	25.0	61.0
Total Split (%)	32.2%	32.2%	40.0%	72.2%	27.8%	67.8%
Yellow Time (s)	3.0	3.0	4.0		3.0	4.0
All-Red Time (s)	1.0	1.0	1.0		1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	4.0	5.0	5.0	4.0	5.0
Lead/Lag			Lag		Lead	
Lead-Lag Optimize?			Yes		Yes	
Recall Mode	None	None	Max		None	Max
Act Effct Green (s)	23.3	23.3	33.2	60.4	18.9	56.0
Actuated g/C Ratio	0.26	0.26	0.38	0.68	0.21	0.63
v/c Ratio	0.73	0.49	0.64	0.46	0.82	0.18
Control Delay	34.9	5.9	29.0	4.8	51.6	7.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	34.9	5.9	29.0	4.8	51.6	7.2
LOS	C	A	C	A	D	A
Approach Delay	25.5		12.7			26.2
Approach LOS	C		B			C













Intersection Summary	
Cycle Length: 90	
Actuated Cycle Length: 88.3	
Natural Cycle: 60	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 0.82	
Intersection Signal Delay: 19.9	Intersection LOS: B
Intersection Capacity Utilization 65.5%	ICU Level of Service C
Analysis Period (min) 15	

Splits and Phases: 7: Wailea Ike Dr. & Wailea Alanui Dr.

























HCM Signalized Intersection Capacity Analysis
 7: Wailea Ike Dr. & Wailea Alanui Dr.

Austin, Tsutsumi & Associates, Inc.
 7/31/2009

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	605	290	410	855	285	380
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	5.0	5.0	4.0	5.0
Lane Util. Factor	0.97	1.00	1.00	0.88	1.00	0.95
Flt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	3433	1583	1863	2787	1770	3539
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	3433	1583	1863	2787	1770	3539
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	658	315	446	929	310	413
RTOR Reduction (vph)	0	232	0	103	0	0
Lane Group Flow (vph)	658	83	446	826	310	413
Turn Type		Perm		pt+ov	Prot	
Protected Phases	8		2	2 8	1	6
Permitted Phases		8				
Actuated Green, G (s)	23.3	23.3	33.2	61.5	18.9	56.1
Effective Green, g (s)	23.3	23.3	33.2	61.5	18.9	56.1
Actuated g/C Ratio	0.26	0.26	0.38	0.70	0.21	0.63
Clearance Time (s)	4.0	4.0	5.0		4.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	905	417	700	1939	378	2246
v/s Ratio Prot	c0.19		c0.24	0.30	c0.18	0.12
v/s Ratio Perm		0.05				
v/c Ratio	0.73	0.20	0.64	0.43	0.82	0.18
Uniform Delay, d1	29.7	25.3	22.7	5.8	33.1	6.7
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	2.9	0.2	4.4	0.2	13.3	0.2
Delay (s)	32.6	25.5	27.1	6.0	46.4	6.9
Level of Service	C	C	C	A	D	A
Approach Delay (s)	30.3		12.8			23.8
Approach LOS	C		B			C
Intersection Summary						
HCM Average Control Delay			20.9		HCM Level of Service	C
HCM Volume to Capacity ratio			0.71			
Actuated Cycle Length (s)			88.4		Sum of lost time (s)	13.0
Intersection Capacity Utilization			65.5%		ICU Level of Service	C
Analysis Period (min)			15			
c Critical Lane Group						











HCM Unsignalized Intersection Capacity Analysis
8: Okolani Dr & Wailea Alanui Dr.

Austin, Tsutsumi & Associates, Inc.
7/31/2009

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control	Stop			Stop			Stop			Stop		
Volume (vph)	15	90	460	95	70	15	510	105	145	15	35	15
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)	16	98	500	103	76	16	554	114	158	16	38	16
Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	NB 1	NB 2	NB 3	SB 1	SB 2		
Volume Total (vph)	16	98	500	179	16	554	114	158	54	16		
Volume Left (vph)	16	0	0	103	0	554	0	0	16	0		
Volume Right (vph)	0	0	500	0	16	0	0	158	0	16		
Hadj (s)	0.53	0.03	-0.67	0.32	-0.67	0.53	0.03	-0.67	0.18	-0.67		
Departure Headway (s)	7.5	7.0	3.2	7.1	6.1	6.2	5.7	3.2	6.6	5.8		
Degree Utilization, x	0.03	0.19	0.44	0.35	0.03	0.95	0.18	0.14	0.10	0.03		
Capacity (veh/h)	463	499	1115	495	567	577	618	1121	518	588		
Control Delay (s)	9.5	10.4	7.5	12.7	8.1	49.1	8.7	5.5	9.2	7.7		
Approach Delay (s)	8.0			12.3			35.2			8.8		
Approach LOS	A			B			E			A		
Intersection Summary												
Delay			21.7									
HCM Level of Service			C									
Intersection Capacity Utilization			57.2%		ICU Level of Service				B			
Analysis Period (min)			15									

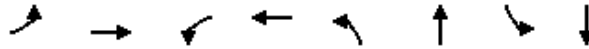
HCM Unsignalized Intersection Capacity Analysis
 9: Kilohana Dr & South Kihei Rd

Austin, Tsutsumi & Associates, Inc.
 7/31/2009

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	35	155	570	25	100	540
Sign Control	Stop		Free		Free	
Grade	0%		0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	38	168	620	27	109	587
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)	1					
Median type			None		None	
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1438	633			647	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1438	633			647	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	71	65			88	
cM capacity (veh/h)	130	480			939	
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	207	647	696			
Volume Left	38	0	109			
Volume Right	168	27	0			
cSH	588	1700	939			
Volume to Capacity	0.35	0.38	0.12			
Queue Length 95th (ft)	39	0	10			
Control Delay (s)	21.6	0.0	2.9			
Lane LOS	C		A			
Approach Delay (s)	21.6	0.0	2.9			
Approach LOS	C					
Intersection Summary						
Average Delay			4.2			
Intersection Capacity Utilization			78.8%	ICU Level of Service	D	
Analysis Period (min)			15			

Timings
10: Grand Wailea Resort & Wailea Alanui Dr.

Austin, Tsutsumi & Associates, Inc.
7/31/2009

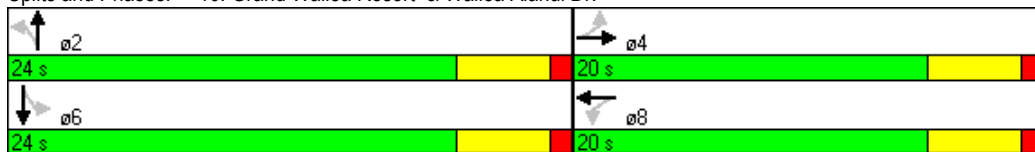


Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations		↕		↕	↖	↗	↖	↗
Volume (vph)	105	5	10	15	30	980	60	675
Turn Type	Perm		Perm		Perm		Perm	
Protected Phases		4		8		2		6
Permitted Phases	4		8		2		6	
Detector Phase	4	4	8	8	2	2	6	6
Switch Phase								
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	20.0	20.0	20.0	24.0	24.0	24.0	24.0
Total Split (s)	20.0	20.0	20.0	20.0	24.0	24.0	24.0	24.0
Total Split (%)	45.5%	45.5%	45.5%	45.5%	54.5%	54.5%	54.5%	54.5%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode	None	None	None	None	Min	Min	Min	Min
Act Effct Green (s)		9.0		9.0	23.1	23.1	23.1	23.1
Actuated g/C Ratio		0.24		0.24	0.61	0.61	0.61	0.61
v/c Ratio		0.44		0.19	0.09	0.50	0.25	0.38
Control Delay		15.1		8.0	7.0	7.8	10.3	6.6
Queue Delay		0.0		0.0	0.0	0.0	0.0	0.0
Total Delay		15.1		8.0	7.0	7.8	10.3	6.6
LOS		B		A	A	A	B	A
Approach Delay		15.1		8.0		7.8		6.9
Approach LOS		B		A		A		A

Intersection Summary

Cycle Length: 44	
Actuated Cycle Length: 38.1	
Natural Cycle: 45	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 0.50	
Intersection Signal Delay: 7.9	Intersection LOS: A
Intersection Capacity Utilization 57.5%	ICU Level of Service B
Analysis Period (min) 15	

Splits and Phases: 10: Grand Wailea Resort & Wailea Alanui Dr.



HCM Signalized Intersection Capacity Analysis
 10: Grand Wailea Resort & Wailea Alanui Dr.

Austin, Tsutsumi & Associates, Inc.
 7/31/2009

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕		↗	↗		↗	↗	
Volume (vph)	105	5	25	10	15	45	30	980	10	60	675	65
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0			5.0		5.0	5.0		5.0	5.0	
Lane Util. Factor		1.00			1.00		1.00	0.95		1.00	0.95	
Flt Protected		0.98			0.91		1.00	1.00		1.00	0.99	
Flt Permitted		0.96			0.99		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1748			1688		1770	3534		1770	3492	
Satd. Flow (perm)		1313			1581		636	3534		426	3492	
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)	114	5	27	11	16	49	33	1065	11	65	734	71
RTOR Reduction (vph)	0	22	0	0	32	0	0	1	0	0	13	0
Lane Group Flow (vph)	0	124	0	0	44	0	33	1075	0	65	792	0
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)		7.5			7.5		21.7	21.7		21.7	21.7	
Effective Green, g (s)		7.5			7.5		21.7	21.7		21.7	21.7	
Actuated g/C Ratio		0.19			0.19		0.55	0.55		0.55	0.55	
Clearance Time (s)		5.0			5.0		5.0	5.0		5.0	5.0	
Vehicle Extension (s)		3.0			3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		251			302		352	1956		236	1933	
v/s Ratio Prot								c0.30			0.23	
v/s Ratio Perm		c0.09			0.03		0.05			0.15		
v/c Ratio		0.49			0.15		0.09	0.55		0.28	0.41	
Uniform Delay, d1		14.2			13.2		4.1	5.6		4.6	5.1	
Progression Factor		1.00			1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2		1.5			0.2		0.1	0.3		0.6	0.1	
Delay (s)		15.7			13.4		4.2	5.9		5.2	5.2	
Level of Service		B			B		A	A		A	A	
Approach Delay (s)		15.7			13.4			5.9			5.2	
Approach LOS		B			B			A			A	
Intersection Summary												
HCM Average Control Delay			6.5								HCM Level of Service	A
HCM Volume to Capacity ratio			0.54									
Actuated Cycle Length (s)			39.2								Sum of lost time (s)	10.0
Intersection Capacity Utilization			57.5%								ICU Level of Service	B
Analysis Period (min)			15									
c Critical Lane Group												

HCM Unsignalized Intersection Capacity Analysis
 11: Kaukahi Dr & Wailea Alanui Dr.

Austin, Tsutsumi & Associates, Inc.
 9/22/2009

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	95	25	10	85	15	5	10	645	100	35	540	65
Sign Control		Stop			Stop			Free			Free	
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)	103	27	11	92	16	5	11	701	109	38	587	71
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	1394	1386	587	1410	1457	701	658			701		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1394	1386	587	1410	1457	701	658			701		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	0	80	98	0	87	99	99			96		
cM capacity (veh/h)	101	135	510	92	123	439	930			896		
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2	SB 1	SB 2	SB 3			
Volume Total	103	38	92	22	712	109	38	587	71			
Volume Left	103	0	92	0	11	0	38	0	0			
Volume Right	0	11	0	5	0	109	0	0	71			
cSH	101	171	92	150	930	1700	896	1700	1700			
Volume to Capacity	1.02	0.22	1.00	0.15	0.01	0.06	0.04	0.35	0.04			
Queue Length 95th (ft)	159	20	148	12	1	0	3	0	0			
Control Delay (s)	172.7	31.9	177.6	33.1	0.3	0.0	9.2	0.0	0.0			
Lane LOS	F	D	F	D	A		A					
Approach Delay (s)	134.8		150.0		0.3		0.5					
Approach LOS	F		F									
Intersection Summary												
Average Delay			20.7									
Intersection Capacity Utilization			60.5%		ICU Level of Service					B		
Analysis Period (min)			15									



APPENDIX C

LEVEL OF SERVICE CALCULATIONS

- Future Year 2022 WITH Project
-

Timings
1: Kilohana Dr & Piilani HWY

Austin, Tsutsumi & Associates, Inc.
1/13/2010

	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	160	20	15	30	160	5	1090	5	50	1705	155
Turn Type	Perm		Perm		Perm	Prot		Perm	Prot		Perm
Protected Phases		4		8		5	2		1	6	
Permitted Phases	4		8		8			2			6
Detector Phase	4	4	8	8	8	5	2	2	1	6	6
Switch Phase											
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	12.0	12.0	12.0	12.0	12.0	10.0	24.0	24.0	10.0	24.0	24.0
Total Split (s)	35.0	35.0	35.0	35.0	35.0	10.0	62.0	62.0	23.0	75.0	75.0
Total Split (%)	29.2%	29.2%	29.2%	29.2%	29.2%	8.3%	51.7%	51.7%	19.2%	62.5%	62.5%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	3.0	4.0	4.0	3.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	4.0	5.0	5.0	4.0	5.0	5.0
Lead/Lag						Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?						Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	Min	Max	Max	Min	Max	Max

Intersection Summary
























Cycle Length: 120
 Actuated Cycle Length: 109
 Natural Cycle: 75
 Control Type: Actuated-Uncoordinated

Splits and Phases: 1: Kilohana Dr & Piilani HWY



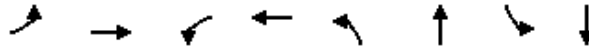
HCM Signalized Intersection Capacity Analysis
 1: Kilohana Dr & Piilani HWY

Austin, Tsutsumi & Associates, Inc.
 1/13/2010

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations													
Volume (vph)	160	20	10	15	30	160	5	1090	5	50	1705	155	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)	5.0	5.0		5.0	5.0	5.0	4.0	5.0	5.0	4.0	5.0	5.0	
Lane Util. Factor	1.00	1.00		1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Flt Protected	1.00	0.95		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1770	1770		1770	1863	1583	1770	3539	1583	1770	3539	1583	
Satd. Flow (perm)	1370	1770		1370	1863	1583	1770	3539	1583	1770	3539	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)	174	22	11	16	33	174	5	1185	5	54	1853	168	
RTOR Reduction (vph)	0	9	0	0	0	144	0	0	2	0	0	48	
Lane Group Flow (vph)	174	24	0	16	33	30	5	1185	3	54	1853	120	
Turn Type	Perm			Perm		Perm	Prot		Perm	Prot		Perm	
Protected Phases		4			8		5	2		1		6	
Permitted Phases	4			8		8			2			6	
Actuated Green, G (s)	19.0	19.0		19.0	19.0	19.0	5.7	67.2	67.2	8.7	70.2	70.2	
Effective Green, g (s)	19.0	19.0		19.0	19.0	19.0	5.7	67.2	67.2	8.7	70.2	70.2	
Actuated g/C Ratio	0.17	0.17		0.17	0.17	0.17	0.05	0.62	0.62	0.08	0.64	0.64	
Clearance Time (s)	5.0	5.0		5.0	5.0	5.0	4.0	5.0	5.0	4.0	5.0	5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	239	309		239	325	276	93	2184	977	141	2281	1020	
v/s Ratio Prot		0.01			0.02		0.00	0.33		c0.03	c0.52		
v/s Ratio Perm	c0.13			0.01		0.02			0.00			0.08	
v/c Ratio	0.73	0.08		0.07	0.10	0.11	0.05	0.54	0.00	0.38	0.81	0.12	
Uniform Delay, d1	42.5	37.6		37.5	37.8	37.8	49.0	12.0	8.0	47.6	14.4	7.4	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	10.5	0.1		0.1	0.1	0.2	0.2	1.0	0.0	1.7	3.3	0.2	
Delay (s)	53.0	37.7		37.7	37.9	38.0	49.3	13.0	8.0	49.3	17.7	7.7	
Level of Service	D	D		D	D	D	D	B	A	D	B	A	
Approach Delay (s)		50.6			38.0			13.1			17.7		
Approach LOS		D			D			B			B		
Intersection Summary													
HCM Average Control Delay			19.3									HCM Level of Service	B
HCM Volume to Capacity ratio			0.78										
Actuated Cycle Length (s)			108.9									Sum of lost time (s)	14.0
Intersection Capacity Utilization			71.0%									ICU Level of Service	C
Analysis Period (min)			15										
c Critical Lane Group													

Timings
2: Okolani Dr. & Piilani HWY

Austin, Tsutsumi & Associates, Inc.
7/31/2009



Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations	↖	↗		↕	↖	↗	↖	↗
Volume (vph)	185	15	40	25	10	840	35	1515
Turn Type	Perm		Perm		Prot		Prot	
Protected Phases		4		8	5	2	1	6
Permitted Phases	4		8					
Detector Phase	4	4	8	8	5	2	1	6
Switch Phase								
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	24.0	24.0	24.0	24.0	10.0	24.0	10.0	24.0
Total Split (s)	27.0	27.0	27.0	27.0	12.0	39.0	14.0	41.0
Total Split (%)	33.8%	33.8%	33.8%	33.8%	15.0%	48.8%	17.5%	51.3%
Yellow Time (s)	4.0	4.0	4.0	4.0	3.0	4.0	3.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	4.0	5.0	4.0	5.0
Lead/Lag					Lead	Lag	Lead	Lag
Lead-Lag Optimize?					Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	Max	None	Max
Act Effct Green (s)	15.9	15.9		15.9	6.1	37.1	7.1	41.8
Actuated g/C Ratio	0.23	0.23		0.23	0.09	0.53	0.10	0.60
v/c Ratio	0.73	0.11		0.36	0.07	0.49	0.21	0.86
Control Delay	41.0	12.8		15.6	33.6	13.9	33.9	19.6
Queue Delay	0.0	0.0		0.0	0.0	0.0	0.0	0.0
Total Delay	41.0	12.8		15.6	33.6	13.9	33.9	19.6
LOS	D	B		B	C	B	C	B
Approach Delay		36.0		15.6		14.1		19.9
Approach LOS		D		B		B		B

Intersection Summary

Cycle Length: 80
 Actuated Cycle Length: 69.8
 Natural Cycle: 80
 Control Type: Actuated-Uncoordinated
 Maximum v/c Ratio: 0.86
 Intersection Signal Delay: 19.2
 Intersection LOS: B
 Intersection Capacity Utilization 71.6%
 ICU Level of Service C
 Analysis Period (min) 15

Splits and Phases: 2: Okolani Dr. & Piilani HWY



HCM Signalized Intersection Capacity Analysis
2: Okolani Dr. & Piilani HWY

Austin, Tsutsumi & Associates, Inc.
7/31/2009

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	185	15	25	40	25	70	10	840	15	35	1515	140
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0			5.0		4.0	5.0		4.0	5.0	
Lane Util. Factor	1.00	1.00			1.00		1.00	0.95		1.00	0.95	
Fr't	1.00	0.91			0.93		1.00	1.00		1.00	0.99	
Flt Protected	0.95	1.00			0.99		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1687			1707		1770	3530		1770	3494	
Flt Permitted	0.65	1.00			0.90		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1217	1687			1561		1770	3530		1770	3494	
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	16	27	43	27	76	11	913	16	38	1647	152
RTOR Reduction (vph)	0	21	0	0	52	0	0	1	0	0	7	0
Lane Group Flow (vph)	201	22	0	0	94	0	11	928	0	38	1792	0
Turn Type	Perm			Perm			Prot			Prot		
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8								
Actuated Green, G (s)	15.9	15.9			15.9		1.3	38.6		4.5	41.8	
Effective Green, g (s)	15.9	15.9			15.9		1.3	38.6		4.5	41.8	
Actuated g/C Ratio	0.22	0.22			0.22		0.02	0.53		0.06	0.57	
Clearance Time (s)	5.0	5.0			5.0		4.0	5.0		4.0	5.0	
Vehicle Extension (s)	3.0	3.0			3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	265	367			340		32	1867		109	2001	
v/s Ratio Prot		0.01					0.01	0.26		c0.02	c0.51	
v/s Ratio Perm	c0.17				0.06							
v/c Ratio	0.76	0.06			0.28		0.34	0.50		0.35	0.90	
Uniform Delay, d1	26.8	22.6			23.8		35.4	11.0		32.8	13.7	
Progression Factor	1.00	1.00			1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	11.7	0.1			0.4		6.3	0.9		1.9	6.7	
Delay (s)	38.5	22.7			24.2		41.8	11.9		34.8	20.4	
Level of Service	D	C			C		D	B		C	C	
Approach Delay (s)		35.7			24.2			12.3			20.7	
Approach LOS		D			C			B			C	
Intersection Summary												
HCM Average Control Delay			19.5				HCM Level of Service			B		
HCM Volume to Capacity ratio			0.86									
Actuated Cycle Length (s)			73.0				Sum of lost time (s)		14.0			
Intersection Capacity Utilization			71.6%				ICU Level of Service		C			
Analysis Period (min)			15									
c Critical Lane Group												

Timings
3: Wailea Ike Dr. & Piilani HWY

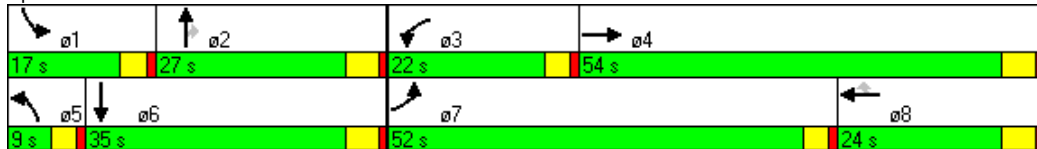
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7/31/2009

	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	635	85	5	95	190	20	105	5	175	70	1425
Turn Type	Prot		Prot		Perm	Prot		Perm	Prot		Free
Protected Phases	7	4	3	8		5	2		1	6	
Permitted Phases					8			2			Free
Detector Phase	7	4	3	8	8	5	2	2	1	6	
Switch Phase											
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	3.0	4.0	4.0	3.0	4.0	
Minimum Split (s)	24.0	24.0	24.0	24.0	24.0	7.0	27.0	27.0	7.0	27.0	
Total Split (s)	52.0	54.0	22.0	24.0	24.0	9.0	27.0	27.0	17.0	35.0	0.0
Total Split (%)	43.3%	45.0%	18.3%	20.0%	20.0%	7.5%	22.5%	22.5%	14.2%	29.2%	0.0%
Yellow Time (s)	3.0	4.0	3.0	4.0	4.0	3.0	4.0	4.0	3.0	4.0	
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	5.0	4.0	5.0	5.0	4.0	5.0	5.0	4.0	5.0	4.0
Lead/Lag	Lead	Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	
Lead-Lag Optimize?											
Recall Mode	None	None	Min	None	None	Min	Min	Min	None	Min	
Act Effct Green (s)	19.2	20.8	10.7	9.5	9.5	5.1	7.9	7.9	9.5	12.2	64.5
Actuated g/C Ratio	0.30	0.32	0.17	0.15	0.15	0.08	0.12	0.12	0.15	0.19	1.00
v/c Ratio	0.68	0.17	0.02	0.38	0.51	0.16	0.26	0.03	0.38	0.22	0.98
Control Delay	24.1	14.4	32.4	31.6	9.7	35.6	30.3	19.8	29.2	25.6	21.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	24.1	14.4	32.4	31.6	9.7	35.6	30.3	19.8	29.2	25.6	21.3
LOS	C	B	C	C	A	D	C	B	C	C	C
Approach Delay		22.8		17.2			30.7			22.3	
Approach LOS		C		B			C			C	

Intersection Summary



























Cycle Length: 120	
Actuated Cycle Length: 64.5	
Natural Cycle: 85	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 0.98	
Intersection Signal Delay: 22.3	Intersection LOS: C
Intersection Capacity Utilization 44.9%	ICU Level of Service A
Analysis Period (min) 15	

Splits and Phases: 3: Wailea Ike Dr. & Piilani HWY



HCM Signalized Intersection Capacity Analysis
 3: Wailea Ike Dr. & Piilani HWY

Austin, Tsutsumi & Associates, Inc.
 7/31/2009

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 							 		 		
Volume (vph)	635	85	10	5	95	190	20	105	5	175	70	1425
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	5.0		4.0	5.0	5.0	4.0	5.0	5.0	4.0	5.0	4.0
Lane Util. Factor	0.97	1.00		1.00	1.00	1.00	1.00	0.95	1.00	0.97	1.00	1.00
Flt Protected	1.00	0.98		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	1833		1770	1863	1583	1770	3539	1583	3433	1863	1583
Satd. Flow (perm)	3433	1833		1770	1863	1583	1770	3539	1583	3433	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)	690	92	11	5	103	207	22	114	5	190	76	1549
RTOR Reduction (vph)	0	4	0	0	0	173	0	0	4	0	0	0
Lane Group Flow (vph)	690	99	0	5	103	34	22	114	1	190	76	1549
Turn Type	Prot			Prot		Perm	Prot		Perm	Prot		Free
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases						8			2			Free
Actuated Green, G (s)	19.2	19.2		10.7	10.7	10.7	5.1	7.9	7.9	9.5	12.3	65.3
Effective Green, g (s)	19.2	19.2		10.7	10.7	10.7	5.1	7.9	7.9	9.5	12.3	65.3
Actuated g/C Ratio	0.29	0.29		0.16	0.16	0.16	0.08	0.12	0.12	0.15	0.19	1.00
Clearance Time (s)	4.0	5.0		4.0	5.0	5.0	4.0	5.0	5.0	4.0	5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	1009	539		290	305	259	138	428	192	499	351	1583
v/s Ratio Prot	0.20	0.05		0.00	0.06		0.01	0.03		0.06	0.04	
v/s Ratio Perm						0.02			0.00			c0.98
v/c Ratio	0.68	0.18		0.02	0.34	0.13	0.16	0.27	0.00	0.38	0.22	0.98
Uniform Delay, d1	20.4	17.2		22.9	24.2	23.3	28.1	26.1	25.2	25.2	22.4	0.0
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.9	0.2		0.0	0.7	0.2	0.5	0.3	0.0	0.5	0.3	18.1
Delay (s)	22.3	17.4		22.9	24.8	23.6	28.6	26.4	25.2	25.7	22.7	18.1
Level of Service	C	B		C	C	C	C	C	C	C	C	B
Approach Delay (s)		21.7			24.0			26.7			19.1	
Approach LOS		C			C			C			B	
Intersection Summary												
HCM Average Control Delay			20.6									HCM Level of Service C
HCM Volume to Capacity ratio			0.98									
Actuated Cycle Length (s)			65.3									Sum of lost time (s) 0.0
Intersection Capacity Utilization			44.9%									ICU Level of Service A
Analysis Period (min)			15									
c Critical Lane Group												

HCM Unsignalized Intersection Capacity Analysis
 4: Wailea Ike Dr. & Kalai Waa St

Austin, Tsutsumi & Associates, Inc.
 7/31/2009

	→	↘	↙	←	↖	↗	
Movement	EBT	EBR	WBL	WBT	NBL	NBR	
Lane Configurations	↑↑		↘	↑↑	↘	↘	
Volume (veh/h)	555	60	255	1255	50	120	
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)	603	65	277	1364	54	130	
Pedestrians							
Lane Width (ft)							
Walking Speed (ft/s)							
Percent Blockage							
Right turn flare (veh)							
Median type	None		None				
Median storage (veh)							
Upstream signal (ft)	749						
pX, platoon unblocked							
vC, conflicting volume			668		1872	334	
vC1, stage 1 conf vol							
vC2, stage 2 conf vol							
vCu, unblocked vol			668		1872	334	
tC, single (s)			4.1		6.8	6.9	
tC, 2 stage (s)							
tF (s)			2.2		3.5	3.3	
p0 queue free %			70		0	80	
cM capacity (veh/h)			917		44	662	
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	WB 3	NB 1	NB 2
Volume Total	402	266	277	682	682	54	130
Volume Left	0	0	277	0	0	54	0
Volume Right	0	65	0	0	0	0	130
cSH	1700	1700	917	1700	1700	44	662
Volume to Capacity	0.24	0.16	0.30	0.40	0.40	1.22	0.20
Queue Length 95th (ft)	0	0	32	0	0	130	18
Control Delay (s)	0.0	0.0	10.6	0.0	0.0	354.2	11.8
Lane LOS			B			F	B
Approach Delay (s)	0.0		1.8			112.5	
Approach LOS						F	
Intersection Summary							
Average Delay			9.5				
Intersection Capacity Utilization			44.7%	ICU Level of Service	A		
Analysis Period (min)			15				

Timings
7: Wailea Ike Dr. & Wailea Alanui Dr.

Austin, Tsutsumi & Associates, Inc.
7/31/2009

	↙	↖	↑	↗	↘	↓
Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↖↗	↖	↑	↖↗	↘	↖↗
Volume (vph)	1000	225	195	405	195	455
Turn Type		Perm		pt+ov	Prot	
Protected Phases	8		2	2 8	1	6
Permitted Phases		8				
Detector Phase	8	8	2	2 8	1	6
Switch Phase						
Minimum Initial (s)	4.0	4.0	4.0		4.0	4.0
Minimum Split (s)	22.0	22.0	24.0		10.0	24.0
Total Split (s)	30.0	30.0	25.0	55.0	15.0	40.0
Total Split (%)	42.9%	42.9%	35.7%	78.6%	21.4%	57.1%
Yellow Time (s)	3.0	3.0	4.0		3.0	4.0
All-Red Time (s)	1.0	1.0	1.0		1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	4.0	5.0	5.0	4.0	5.0
Lead/Lag			Lag		Lead	
Lead-Lag Optimize?			Yes		Yes	
Recall Mode	None	None	Max		None	Max
Act Effct Green (s)	25.2	25.2	20.4	49.6	10.6	35.0
Actuated g/C Ratio	0.36	0.36	0.29	0.72	0.15	0.51
v/c Ratio	0.87	0.33	0.39	0.21	0.78	0.28
Control Delay	29.8	3.8	22.5	1.2	50.5	10.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	29.8	3.8	22.5	1.2	50.5	10.5
LOS	C	A	C	A	D	B
Approach Delay	25.0		8.1			22.5
Approach LOS	C		A			C













Intersection Summary	
Cycle Length:	70
Actuated Cycle Length:	69.2
Natural Cycle:	60
Control Type:	Actuated-Uncoordinated
Maximum v/c Ratio:	0.87
Intersection Signal Delay:	20.3
Intersection LOS:	C
Intersection Capacity Utilization:	60.4%
ICU Level of Service:	B
Analysis Period (min):	15

Splits and Phases: 7: Wailea Ike Dr. & Wailea Alanui Dr.

























HCM Signalized Intersection Capacity Analysis
 7: Wailea Ike Dr. & Wailea Alanui Dr.

Austin, Tsutsumi & Associates, Inc.
 7/31/2009

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	1000	225	195	405	195	455
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	5.0	5.0	4.0	5.0
Lane Util. Factor	0.97	1.00	1.00	0.88	1.00	0.95
Flt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	3433	1583	1863	2787	1770	3539
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	3433	1583	1863	2787	1770	3539
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	1087	245	212	440	212	495
RTOR Reduction (vph)	0	156	0	88	0	0
Lane Group Flow (vph)	1087	89	212	352	212	495
Turn Type		Perm		pt+ov	Prot	
Protected Phases	8		2	2 8	1	6
Permitted Phases		8				
Actuated Green, G (s)	25.2	25.2	20.4	50.6	10.6	35.0
Effective Green, g (s)	25.2	25.2	20.4	50.6	10.6	35.0
Actuated g/C Ratio	0.36	0.36	0.29	0.73	0.15	0.51
Clearance Time (s)	4.0	4.0	5.0		4.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	1250	576	549	2038	271	1790
v/s Ratio Prot	c0.32		c0.11	0.13	c0.12	0.14
v/s Ratio Perm		0.06				
v/c Ratio	0.87	0.15	0.39	0.17	0.78	0.28
Uniform Delay, d1	20.5	14.8	19.4	2.9	28.2	9.8
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	6.7	0.1	2.0	0.0	13.7	0.4
Delay (s)	27.2	15.0	21.5	2.9	41.8	10.2
Level of Service	C	B	C	A	D	B
Approach Delay (s)	24.9		8.9			19.7
Approach LOS	C		A			B
Intersection Summary						
HCM Average Control Delay			19.7		HCM Level of Service	B
HCM Volume to Capacity ratio			0.68			
Actuated Cycle Length (s)			69.2		Sum of lost time (s)	13.0
Intersection Capacity Utilization			60.4%		ICU Level of Service	B
Analysis Period (min)			15			
c Critical Lane Group						

HCM Unsignalized Intersection Capacity Analysis
 8: Okolani Dr & Wailea Alanui Dr.

Austin, Tsutsumi & Associates, Inc.
 7/31/2009

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control	Stop			Stop			Stop			Stop		
Volume (vph)	10	50	525	105	65	5	260	30	60	10	70	10
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	54	571	114	71	5	283	33	65	11	76	11
Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	NB 1	NB 2	NB 3	SB 1	SB 2		
Volume Total (vph)	11	54	571	185	5	283	33	65	87	11		
Volume Left (vph)	11	0	0	114	0	283	0	0	11	0		
Volume Right (vph)	0	0	571	0	5	0	0	65	0	11		
Hadj (s)	0.53	0.03	-0.67	0.34	-0.67	0.53	0.03	-0.67	0.10	-0.67		
Departure Headway (s)	6.4	5.9	3.2	6.1	5.1	5.9	5.4	3.2	5.7	5.0		
Degree Utilization, x	0.02	0.09	0.51	0.31	0.01	0.46	0.05	0.06	0.14	0.01		
Capacity (veh/h)	517	562	1116	565	663	593	637	1121	596	679		
Control Delay (s)	8.4	8.3	8.2	10.6	6.9	12.7	7.5	5.2	8.4	6.8		
Approach Delay (s)	8.3			10.5			10.9			8.3		
Approach LOS	A			B			B			A		
Intersection Summary												
Delay	9.4											
HCM Level of Service	A											
Intersection Capacity Utilization	56.0%			ICU Level of Service			B					
Analysis Period (min)	15											

HCM Unsignalized Intersection Capacity Analysis
 9: Kilohana Dr & South Kihei Rd

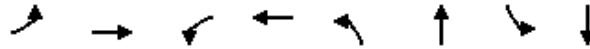
Austin, Tsutsumi & Associates, Inc.
 7/31/2009



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	10	95	310	10	100	565
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	11	103	337	11	109	614
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)		1				
Median type			None			None
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1174	342			348	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1174	342			348	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	94	85			91	
cM capacity (veh/h)	193	700			1211	
Direction, Lane #						
	WB 1	NB 1	SB 1			
Volume Total	114	348	723			
Volume Left	11	0	109			
Volume Right	103	11	0			
cSH	774	1700	1211			
Volume to Capacity	0.15	0.20	0.09			
Queue Length 95th (ft)	13	0	7			
Control Delay (s)	12.3	0.0	2.2			
Lane LOS	B		A			
Approach Delay (s)	12.3	0.0	2.2			
Approach LOS	B					
Intersection Summary						
Average Delay			2.5			
Intersection Capacity Utilization		65.5%		ICU Level of Service		C
Analysis Period (min)			15			

Timings
10: Grand Wailea Resort & Wailea Alanui Dr.

Austin, Tsutsumi & Associates, Inc.
7/31/2009

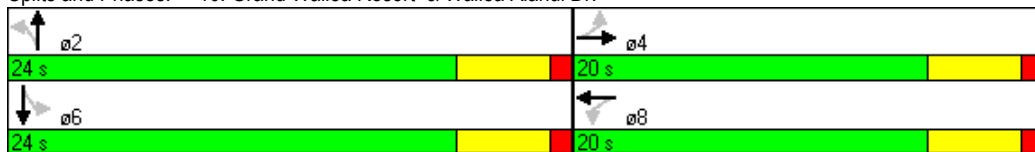


Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations		↕		↕	↖	↗	↖	↗
Volume (vph)	35	5	10	5	20	470	180	1000
Turn Type	Perm		Perm		Perm		Perm	
Protected Phases		4		8		2		6
Permitted Phases	4		8		2		6	
Detector Phase	4	4	8	8	2	2	6	6
Switch Phase								
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	20.0	20.0	20.0	24.0	24.0	24.0	24.0
Total Split (s)	20.0	20.0	20.0	20.0	24.0	24.0	24.0	24.0
Total Split (%)	45.5%	45.5%	45.5%	45.5%	54.5%	54.5%	54.5%	54.5%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode	None	None	None	None	Min	Min	Min	Min
Act Effct Green (s)		6.7		6.5	28.1	28.1	28.1	28.1
Actuated g/C Ratio		0.19		0.19	0.81	0.81	0.81	0.81
v/c Ratio		0.17		0.21	0.07	0.19	0.29	0.42
Control Delay		10.9		7.6	4.8	3.1	5.7	4.2
Queue Delay		0.0		0.0	0.0	0.0	0.0	0.0
Total Delay		10.9		7.6	4.8	3.1	5.7	4.2
LOS		B		A	A	A	A	A
Approach Delay		10.9		7.6		3.1		4.4
Approach LOS		B		A		A		A

Intersection Summary



















Cycle Length: 44
 Actuated Cycle Length: 34.7
 Natural Cycle: 45
 Control Type: Actuated-Uncoordinated
 Maximum v/c Ratio: 0.42
 Intersection Signal Delay: 4.3
 Intersection LOS: A
 Intersection Capacity Utilization 56.2%
 ICU Level of Service B
 Analysis Period (min) 15

Splits and Phases: 10: Grand Wailea Resort & Wailea Alanui Dr.
























HCM Signalized Intersection Capacity Analysis
 10: Grand Wailea Resort & Wailea Alanui Dr.

Austin, Tsutsumi & Associates, Inc.
 7/31/2009

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	35	5	15	10	5	50	20	470	25	180	1000	100
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0			5.0		5.0	5.0		5.0	5.0	
Lane Util. Factor		1.00			1.00		1.00	0.95		1.00	0.95	
Flt Protected		0.96			0.90		1.00	0.99		1.00	0.99	
Flt Permitted		0.97			0.99		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1739			1656		1770	3513		1770	3491	
Satd. Flow (perm)		1795			1555		405	3513		841	3491	
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)	38	5	16	11	5	54	22	511	27	196	1087	109
RTOR Reduction (vph)	0	15	0	0	50	0	0	5	0	0	10	0
Lane Group Flow (vph)	0	44	0	0	20	0	22	533	0	196	1186	0
Turn Type	Perm		Perm			Perm			Perm			
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)		2.9			2.9		24.9	24.9		24.9	24.9	
Effective Green, g (s)		2.9			2.9		24.9	24.9		24.9	24.9	
Actuated g/C Ratio		0.08			0.08		0.66	0.66		0.66	0.66	
Clearance Time (s)		5.0			5.0		5.0	5.0		5.0	5.0	
Vehicle Extension (s)		3.0			3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		138			119		267	2314		554	2300	
v/s Ratio Prot								0.15			c0.34	
v/s Ratio Perm		c0.02			0.01		0.05			0.23		
v/c Ratio		0.32			0.17		0.08	0.23		0.35	0.52	
Uniform Delay, d1		16.5			16.3		2.3	2.6		2.9	3.3	
Progression Factor		1.00			1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2		1.3			0.7		0.1	0.1		0.4	0.2	
Delay (s)		17.9			17.0		2.5	2.6		3.3	3.5	
Level of Service		B			B		A	A		A	A	
Approach Delay (s)		17.9			17.0			2.6			3.5	
Approach LOS		B			B			A			A	
Intersection Summary												
HCM Average Control Delay			4.1					HCM Level of Service			A	
HCM Volume to Capacity ratio			0.50									
Actuated Cycle Length (s)			37.8					Sum of lost time (s)		10.0		
Intersection Capacity Utilization			56.2%					ICU Level of Service		B		
Analysis Period (min)			15									
c Critical Lane Group												

HCM Unsignalized Intersection Capacity Analysis
 11: Kaukahi Dr & Wailea Alanui Dr.

Austin, Tsutsumi & Associates, Inc.
 7/31/2009

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	30	20	5	90	30	35	5	345	50	20	590	145
Sign Control		Stop			Stop			Free			Free	
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)	33	22	5	98	33	38	5	375	54	22	641	158
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type												
Median storage veh												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1087	1071	641	1087	1228	375	799			375		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1087	1071	641	1087	1228	375	799			375		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	79	90	99	44	81	94	99			98		
cM capacity (veh/h)	153	215	475	173	174	671	824			1183		
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2	SB 1	SB 2	SB 3			
Volume Total	33	27	130	38	380	54	22	641	158			
Volume Left	33	0	98	0	5	0	22	0	0			
Volume Right	0	5	0	38	0	54	0	0	158			
cSH	153	242	173	671	824	1700	1183	1700	1700			
Volume to Capacity	0.21	0.11	0.75	0.06	0.01	0.03	0.02	0.38	0.09			
Queue Length 95th (ft)	19	9	120	4	0	0	1	0	0			
Control Delay (s)	34.7	21.8	70.7	10.7	0.2	0.0	8.1	0.0	0.0			
Lane LOS	D	C	F	B	A		A					
Approach Delay (s)	28.8		57.2		0.2		0.2					
Approach LOS	D		F									
Intersection Summary												
Average Delay			7.8									
Intersection Capacity Utilization			50.9%		ICU Level of Service					A		
Analysis Period (min)			15									

Timings
1: Kilohana Dr & Piilani HWY

Austin, Tsutsumi & Associates, Inc.
1/13/2010

Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	175	40	10	35	140	20	1965	15	160	1665	230
Turn Type	Perm		Perm		Perm	Prot		Perm	Prot		Perm
Protected Phases		4		8		5	2		1	6	
Permitted Phases	4		8		8			2			6
Detector Phase	4	4	8	8	8	5	2	2	1	6	6
Switch Phase											
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	12.0	12.0	12.0	12.0	12.0	10.0	24.0	24.0	10.0	24.0	24.0
Total Split (s)	25.0	25.0	25.0	25.0	25.0	15.0	77.0	77.0	18.0	80.0	80.0
Total Split (%)	20.8%	20.8%	20.8%	20.8%	20.8%	12.5%	64.2%	64.2%	15.0%	66.7%	66.7%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	3.0	4.0	4.0	3.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	4.0	5.0	5.0	4.0	5.0	5.0
Lead/Lag						Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?						Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	Min	Max	Max	Min	Max	Max

Intersection Summary
























Cycle Length: 120
 Actuated Cycle Length: 118.6
 Natural Cycle: 90
 Control Type: Actuated-Uncoordinated

Splits and Phases: 1: Kilohana Dr & Piilani HWY



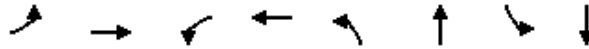
HCM Signalized Intersection Capacity Analysis
 1: Kilohana Dr & Piilani HWY

Austin, Tsutsumi & Associates, Inc.
 1/13/2010

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	175	40	10	10	35	140	20	1965	15	160	1665	230
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0	5.0	4.0	5.0	5.0	4.0	5.0	5.0
Lane Util. Factor	1.00	1.00		1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Flt Protected	1.00	0.97		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	1806		1770	1863	1583	1770	3539	1583	1770	3539	1583
Satd. Flow (perm)	1364	1806		1345	1863	1583	1770	3539	1583	1770	3539	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)	190	43	11	11	38	152	22	2136	16	174	1810	250
RTOR Reduction (vph)	0	8	0	0	0	128	0	0	5	0	0	78
Lane Group Flow (vph)	190	46	0	11	38	24	22	2136	11	174	1810	172
Turn Type	Perm			Perm		Perm	Prot		Perm	Prot		Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8		8			2			6
Actuated Green, G (s)	18.9	18.9		18.9	18.9	18.9	7.0	72.0	72.0	13.6	78.6	78.6
Effective Green, g (s)	18.9	18.9		18.9	18.9	18.9	7.0	72.0	72.0	13.6	78.6	78.6
Actuated g/C Ratio	0.16	0.16		0.16	0.16	0.16	0.06	0.61	0.61	0.11	0.66	0.66
Clearance Time (s)	5.0	5.0		5.0	5.0	5.0	4.0	5.0	5.0	4.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	218	288		215	297	252	105	2150	962	203	2347	1050
v/s Ratio Prot		0.03			0.02		0.01	c0.60		c0.10	0.51	
v/s Ratio Perm	c0.14			0.01		0.02			0.01			0.11
v/c Ratio	0.87	0.16		0.05	0.13	0.10	0.21	0.99	0.01	0.86	0.77	0.16
Uniform Delay, d1	48.6	43.0		42.2	42.7	42.5	53.1	23.0	9.2	51.5	13.8	7.5
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	29.4	0.3		0.1	0.2	0.2	1.0	17.9	0.0	28.1	2.5	0.3
Delay (s)	78.0	43.2		42.3	42.9	42.7	54.1	41.0	9.2	79.6	16.3	7.9
Level of Service	E	D		D	D	D	D	D	A	E	B	A
Approach Delay (s)		70.3			42.7			40.9			20.3	
Approach LOS		E			D			D			C	
Intersection Summary												
HCM Average Control Delay			32.9									HCM Level of Service C
HCM Volume to Capacity ratio			0.95									
Actuated Cycle Length (s)			118.5									Sum of lost time (s) 14.0
Intersection Capacity Utilization			91.2%									ICU Level of Service F
Analysis Period (min)			15									
c Critical Lane Group												

Timings
2: Okolani Dr. & Piilani HWY

Austin, Tsutsumi & Associates, Inc.
7/31/2009



Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations	↶	↷		↷	↶	↷	↶	↷
Volume (vph)	255	35	15	25	40	1640	85	1310
Turn Type	Perm		Perm		Prot		Prot	
Protected Phases		4		8	5	2	1	6
Permitted Phases	4		8					
Detector Phase	4	4	8	8	5	2	1	6
Switch Phase								
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	24.0	24.0	24.0	24.0	10.0	24.0	10.0	24.0
Total Split (s)	34.0	34.0	34.0	34.0	12.0	52.0	14.0	54.0
Total Split (%)	34.0%	34.0%	34.0%	34.0%	12.0%	52.0%	14.0%	54.0%
Yellow Time (s)	4.0	4.0	4.0	4.0	3.0	4.0	3.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	4.0	5.0	4.0	5.0
Lead/Lag					Lead	Lag	Lead	Lag
Lead-Lag Optimize?					Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	Max	None	Max
Act Effct Green (s)	23.2	23.2		23.2	7.1	48.3	8.9	52.1
Actuated g/C Ratio	0.25	0.25		0.25	0.08	0.52	0.10	0.57
v/c Ratio	0.83	0.15		0.21	0.31	0.99	0.54	0.87
Control Delay	54.1	17.2		15.1	49.3	43.6	54.2	26.3
Queue Delay	0.0	0.0		0.0	0.0	0.0	0.0	0.0
Total Delay	54.1	17.2		15.1	49.3	43.6	54.2	26.3
LOS	D	B		B	D	D	D	C
Approach Delay		46.6		15.1		43.8		27.7
Approach LOS		D		B		D		C

Intersection Summary




















Cycle Length: 100
 Actuated Cycle Length: 92.1
 Natural Cycle: 90
 Control Type: Actuated-Uncoordinated
 Maximum v/c Ratio: 0.99
 Intersection Signal Delay: 36.3
 Intersection LOS: D
 Intersection Capacity Utilization 83.9%
 ICU Level of Service E
 Analysis Period (min) 15

Splits and Phases: 2: Okolani Dr. & Piilani HWY



HCM Signalized Intersection Capacity Analysis
2: Okolani Dr. & Piilani HWY

Austin, Tsutsumi & Associates, Inc.
7/31/2009

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations													
Volume (vph)	255	35	30	15	25	50	40	1640	45	85	1310	270	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)	5.0	5.0			5.0		4.0	5.0		4.0	5.0		
Lane Util. Factor	1.00	1.00			1.00		1.00	0.95		1.00	0.95		
Flt Protected	1.00	0.93			0.92		1.00	1.00		1.00	0.97		
Flt Permitted	0.95	1.00			0.99		0.95	1.00		0.95	1.00		
Satd. Flow (prot)	1770	1733			1709		1770	3525		1770	3449		
Satd. Flow (perm)	1323	1733			1646		1770	3525		1770	3449		
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)	277	38	33	16	27	54	43	1783	49	92	1424	293	
RTOR Reduction (vph)	0	25	0	0	41	0	0	2	0	0	15	0	
Lane Group Flow (vph)	277	46	0	0	56	0	43	1830	0	92	1702	0	
Turn Type	Perm		Perm				Prot		Prot				
Protected Phases	4		8				5		2		1		6
Permitted Phases	4		8										
Actuated Green, G (s)	23.2	23.2			23.2		4.4	49.2		7.3	52.1		
Effective Green, g (s)	23.2	23.2			23.2		4.4	49.2		7.3	52.1		
Actuated g/C Ratio	0.25	0.25			0.25		0.05	0.53		0.08	0.56		
Clearance Time (s)	5.0	5.0			5.0		4.0	5.0		4.0	5.0		
Vehicle Extension (s)	3.0	3.0			3.0		3.0	3.0		3.0	3.0		
Lane Grp Cap (vph)	328	429			408		83	1851		138	1918		
v/s Ratio Prot	0.03						0.02		c0.52		c0.05		c0.49
v/s Ratio Perm	c0.21		0.03										
v/c Ratio	0.84	0.11			0.14		0.52	0.99		0.67	0.89		
Uniform Delay, d1	33.5	27.2			27.5		43.6	22.0		42.0	18.2		
Progression Factor	1.00	1.00			1.00		1.00	1.00		1.00	1.00		
Incremental Delay, d2	17.7	0.1			0.2		5.4	18.4		11.5	6.5		
Delay (s)	51.2	27.4			27.6		49.0	40.4		53.5	24.8		
Level of Service	D	C			C		D	D		D	C		
Approach Delay (s)	46.4		27.6				40.6				26.2		
Approach LOS	D		C				D				C		
Intersection Summary													
HCM Average Control Delay	34.5		HCM Level of Service				C						
HCM Volume to Capacity ratio	0.97												
Actuated Cycle Length (s)	93.7		Sum of lost time (s)				19.0						
Intersection Capacity Utilization	83.9%		ICU Level of Service				E						
Analysis Period (min)	15												
c Critical Lane Group													

Timings
3: Wailea Ike Dr. & Piilani HWY

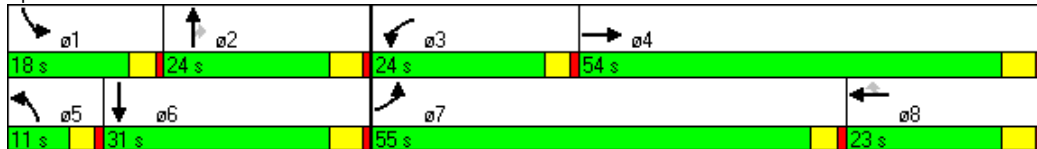
Austin, Tsutsumi & Associates, Inc.
7/31/2009

	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	1520	130	5	135	285	15	105	5	290	130	1005
Turn Type	Prot		Prot		Perm	Prot		Perm	Prot		Free
Protected Phases	7	4	3	8		5	2		1	6	
Permitted Phases					8			2			Free
Detector Phase	7	4	3	8	8	5	2	2	1	6	
Switch Phase											
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	3.0	4.0	4.0	3.0	4.0	
Minimum Split (s)	24.0	24.0	24.0	24.0	24.0	7.0	27.0	27.0	7.0	27.0	
Total Split (s)	55.0	54.0	24.0	23.0	23.0	11.0	24.0	24.0	18.0	31.0	0.0
Total Split (%)	45.8%	45.0%	20.0%	19.2%	19.2%	9.2%	20.0%	20.0%	15.0%	25.8%	0.0%
Yellow Time (s)	3.0	4.0	3.0	4.0	4.0	3.0	4.0	4.0	3.0	4.0	
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	5.0	4.0	5.0	5.0	4.0	5.0	5.0	4.0	5.0	4.0
Lead/Lag	Lead	Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	
Lead-Lag Optimize?											
Recall Mode	None	None	Min	None	None	Min	Min	Min	None	Min	
Act Effct Green (s)	51.2	58.6	5.9	13.3	13.3	6.3	8.8	8.8	13.2	15.8	104.6
Actuated g/C Ratio	0.49	0.56	0.06	0.13	0.13	0.06	0.08	0.08	0.13	0.15	1.00
v/c Ratio	0.98	0.16	0.05	0.62	0.73	0.15	0.38	0.04	0.72	0.50	0.69
Control Delay	46.2	11.5	50.4	55.4	20.9	52.1	50.0	28.0	55.2	48.3	2.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	46.2	11.5	50.4	55.4	20.9	52.1	50.0	28.0	55.2	48.3	2.5
LOS	D	B	D	E	C	D	D	C	E	D	A
Approach Delay		43.1		32.2			49.4			17.4	
Approach LOS		D		C			D			B	

Intersection Summary



























Cycle Length: 120
 Actuated Cycle Length: 104.6
 Natural Cycle: 135
 Control Type: Actuated-Uncoordinated
 Maximum v/c Ratio: 0.98
 Intersection Signal Delay: 32.0
 Intersection LOS: C
 Intersection Capacity Utilization 77.1%
 ICU Level of Service D
 Analysis Period (min) 15

Splits and Phases: 3: Wailea Ike Dr. & Piilani HWY



HCM Signalized Intersection Capacity Analysis
 3: Wailea Ike Dr. & Piilani HWY

Austin, Tsutsumi & Associates, Inc.
 7/31/2009

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 							 		 		
Volume (vph)	1520	130	20	5	135	285	15	105	5	290	130	1005
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	5.0		4.0	5.0	5.0	4.0	5.0	5.0	4.0	5.0	4.0
Lane Util. Factor	0.97	1.00		1.00	1.00	1.00	1.00	0.95	1.00	0.97	1.00	1.00
Flt Protected	1.00	0.98		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	1825		1770	1863	1583	1770	3539	1583	3433	1863	1583
Satd. Flow (perm)	3433	1825		1770	1863	1583	1770	3539	1583	3433	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)	1652	141	22	5	147	310	16	114	5	315	141	1092
RTOR Reduction (vph)	0	4	0	0	0	222	0	0	5	0	0	0
Lane Group Flow (vph)	1652	159	0	5	147	88	16	114	0	315	141	1092
Turn Type	Prot			Prot		Perm	Prot		Perm	Prot		Free
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases						8			2			Free
Actuated Green, G (s)	51.2	58.6		5.9	13.3	13.3	6.3	8.9	8.9	13.2	15.8	104.6
Effective Green, g (s)	51.2	58.6		5.9	13.3	13.3	6.3	8.9	8.9	13.2	15.8	104.6
Actuated g/C Ratio	0.49	0.56		0.06	0.13	0.13	0.06	0.09	0.09	0.13	0.15	1.00
Clearance Time (s)	4.0	5.0		4.0	5.0	5.0	4.0	5.0	5.0	4.0	5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	1680	1022		100	237	201	107	301	135	433	281	1583
v/s Ratio Prot	c0.48	0.09		0.00	0.08		0.01	0.03		0.09	0.08	
v/s Ratio Perm						0.06			0.00			c0.69
v/c Ratio	0.98	0.16		0.05	0.62	0.44	0.15	0.38	0.00	0.73	0.50	0.69
Uniform Delay, d1	26.3	11.1		46.7	43.3	42.2	46.6	45.2	43.8	44.0	40.8	0.0
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	18.0	0.1		0.2	5.0	1.5	0.6	0.8	0.0	6.0	1.4	2.5
Delay (s)	44.3	11.2		46.9	48.2	43.7	47.3	46.0	43.8	50.0	42.2	2.5
Level of Service	D	B		D	D	D	D	D	D	D	D	A
Approach Delay (s)		41.3			45.2			46.1			15.8	
Approach LOS		D			D			D			B	
Intersection Summary												
HCM Average Control Delay			31.9									HCM Level of Service C
HCM Volume to Capacity ratio			0.84									
Actuated Cycle Length (s)			104.6									Sum of lost time (s) 4.0
Intersection Capacity Utilization			77.1%									ICU Level of Service D
Analysis Period (min)			15									
c Critical Lane Group												

HCM Unsignalized Intersection Capacity Analysis
4: Wailea Ike Dr. & Kalai Waa St

Austin, Tsutsumi & Associates, Inc.
7/31/2009

	→	↘	↙	←	↖	↗		
Movement	EBT	EBR	WBL	WBT	NBL	NBR		
Lane Configurations	↑↑		↘	↑↑	↘	↘		
Volume (veh/h)	1265	90	165	925	100	290		
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)	1375	98	179	1005	109	315		
Pedestrians								
Lane Width (ft)								
Walking Speed (ft/s)								
Percent Blockage								
Right turn flare (veh)								
Median type	None		None					
Median storage (veh)								
Upstream signal (ft)	749							
pX, platoon unblocked								
vC, conflicting volume			1473		2285	736		
vC1, stage 1 conf vol								
vC2, stage 2 conf vol								
vCu, unblocked vol			1473		2285	736		
tC, single (s)			4.1		6.8	6.9		
tC, 2 stage (s)								
tF (s)			2.2		3.5	3.3		
p0 queue free %			60		0	13		
cM capacity (veh/h)			454		20	361		
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	WB 3	NB 1	NB 2	
Volume Total	917	556	179	503	503	109	315	
Volume Left	0	0	179	0	0	109	0	
Volume Right	0	98	0	0	0	0	315	
cSH	1700	1700	454	1700	1700	20	361	
Volume to Capacity	0.54	0.33	0.40	0.30	0.30	5.40	0.87	
Queue Length 95th (ft)	0	0	47	0	0	Err	209	
Control Delay (s)	0.0	0.0	18.0	0.0	0.0	Err	55.1	
Lane LOS			C				F	F
Approach Delay (s)	0.0		2.7				2604.8	
Approach LOS							F	
Intersection Summary								
Average Delay			359.4					
Intersection Capacity Utilization			62.5%	ICU Level of Service	B			
Analysis Period (min)			15					

Timings
7: Wailea Ike Dr. & Wailea Alanui Dr.

Austin, Tsutsumi & Associates, Inc.
7/31/2009

	↙	↖	↑	↗	↘	↓
Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↗↗	↖	↑	↗↗	↘	↗↗
Volume (vph)	675	295	435	940	295	400
Turn Type		Perm		pt+ov	Prot	
Protected Phases	8		2	2 8	1	6
Permitted Phases		8				
Detector Phase	8	8	2	2 8	1	6
Switch Phase						
Minimum Initial (s)	4.0	4.0	4.0		4.0	4.0
Minimum Split (s)	22.0	22.0	24.0		10.0	24.0
Total Split (s)	29.0	29.0	36.0	65.0	25.0	61.0
Total Split (%)	32.2%	32.2%	40.0%	72.2%	27.8%	67.8%
Yellow Time (s)	3.0	3.0	4.0		3.0	4.0
All-Red Time (s)	1.0	1.0	1.0		1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	4.0	5.0	5.0	4.0	5.0
Lead/Lag			Lag		Lead	
Lead-Lag Optimize?			Yes		Yes	
Recall Mode	None	None	Max		None	Max
Act Effct Green (s)	24.0	24.0	32.8	60.8	19.2	56.1
Actuated g/C Ratio	0.27	0.27	0.37	0.68	0.22	0.63
v/c Ratio	0.79	0.48	0.69	0.51	0.84	0.20
Control Delay	37.4	5.8	31.2	5.6	53.6	7.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	37.4	5.8	31.2	5.6	53.6	7.4
LOS	D	A	C	A	D	A
Approach Delay	27.8		13.7			27.0
Approach LOS	C		B			C













Intersection Summary	
Cycle Length: 90	
Actuated Cycle Length: 89.1	
Natural Cycle: 65	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 0.84	
Intersection Signal Delay: 21.3	Intersection LOS: C
Intersection Capacity Utilization 69.3%	ICU Level of Service C
Analysis Period (min) 15	

Splits and Phases: 7: Wailea Ike Dr. & Wailea Alanui Dr.

























HCM Signalized Intersection Capacity Analysis
 7: Wailea Ike Dr. & Wailea Alanui Dr.

Austin, Tsutsumi & Associates, Inc.
 7/31/2009

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	675	295	435	940	295	400
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	5.0	5.0	4.0	5.0
Lane Util. Factor	0.97	1.00	1.00	0.88	1.00	0.95
Flt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	3433	1583	1863	2787	1770	3539
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	3433	1583	1863	2787	1770	3539
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	734	321	473	1022	321	435
RTOR Reduction (vph)	0	234	0	97	0	0
Lane Group Flow (vph)	734	87	473	925	321	435
Turn Type		Perm		pt+ov	Prot	
Protected Phases	8		2	2 8	1	6
Permitted Phases		8				
Actuated Green, G (s)	24.0	24.0	32.8	61.8	19.2	56.0
Effective Green, g (s)	24.0	24.0	32.8	61.8	19.2	56.0
Actuated g/C Ratio	0.27	0.27	0.37	0.69	0.22	0.63
Clearance Time (s)	4.0	4.0	5.0		4.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	926	427	687	1935	382	2227
v/s Ratio Prot	c0.21		c0.25	0.33	c0.18	0.12
v/s Ratio Perm		0.05				
v/c Ratio	0.79	0.20	0.69	0.48	0.84	0.20
Uniform Delay, d1	30.2	25.1	23.8	6.2	33.4	7.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	4.7	0.2	5.6	0.2	15.2	0.2
Delay (s)	34.9	25.3	29.3	6.4	48.7	7.2
Level of Service	C	C	C	A	D	A
Approach Delay (s)	32.0		13.7			24.8
Approach LOS	C		B			C
Intersection Summary						
HCM Average Control Delay			22.1		HCM Level of Service	C
HCM Volume to Capacity ratio			0.76			
Actuated Cycle Length (s)			89.0		Sum of lost time (s)	13.0
Intersection Capacity Utilization			69.3%		ICU Level of Service	C
Analysis Period (min)			15			
c Critical Lane Group						











HCM Unsignalized Intersection Capacity Analysis
8: Okolani Dr & Wailea Alanui Dr.

Austin, Tsutsumi & Associates, Inc.
7/31/2009

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control	Stop			Stop			Stop			Stop		
Volume (vph)	15	95	490	100	70	15	535	110	145	15	35	15
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)	16	103	533	109	76	16	582	120	158	16	38	16
Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	NB 1	NB 2	NB 3	SB 1	SB 2		
Volume Total (vph)	16	103	533	185	16	582	120	158	54	16		
Volume Left (vph)	16	0	0	109	0	582	0	0	16	0		
Volume Right (vph)	0	0	533	0	16	0	0	158	0	16		
Hadj (s)	0.53	0.03	-0.67	0.33	-0.67	0.53	0.03	-0.67	0.18	-0.67		
Departure Headway (s)	7.6	7.1	3.2	7.2	6.2	6.2	5.7	3.2	6.7	5.9		
Degree Utilization, x	0.03	0.20	0.47	0.37	0.03	1.00	0.19	0.14	0.10	0.03		
Capacity (veh/h)	461	497	1116	493	565	582	614	1121	513	582		
Control Delay (s)	9.6	10.7	7.8	13.1	8.2	62.0	8.9	5.5	9.3	7.9		
Approach Delay (s)	8.3			12.7			44.3			9.0		
Approach LOS	A			B			E			A		
Intersection Summary												
Delay	26.2											
HCM Level of Service	D											
Intersection Capacity Utilization	58.9%			ICU Level of Service			B					
Analysis Period (min)	15											

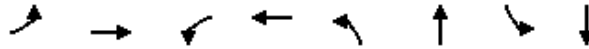
HCM Unsignalized Intersection Capacity Analysis
 9: Kilohana Dr & South Kihei Rd

Austin, Tsutsumi & Associates, Inc.
 7/31/2009

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	35	155	600	25	100	570
Sign Control	Stop		Free		Free	
Grade	0%		0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	38	168	652	27	109	620
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)	1					
Median type			None		None	
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1503	666			679	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1503	666			679	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	68	63			88	
cM capacity (veh/h)	118	460			913	
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	207	679	728			
Volume Left	38	0	109			
Volume Right	168	27	0			
cSH	431	1700	913			
Volume to Capacity	0.48	0.40	0.12			
Queue Length 95th (ft)	63	0	10			
Control Delay (s)	20.8	0.0	2.9			
Lane LOS	C		A			
Approach Delay (s)	20.8	0.0	2.9			
Approach LOS	C					
Intersection Summary						
Average Delay			4.0			
Intersection Capacity Utilization			82.0%		ICU Level of Service	D
Analysis Period (min)			15			

Timings
10: Grand Wailea Resort & Wailea Alanui Dr.

Austin, Tsutsumi & Associates, Inc.
7/31/2009

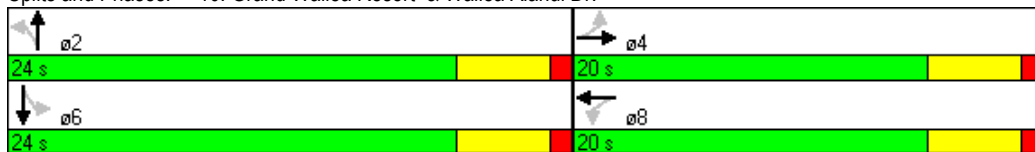


Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations		↕		↕	↖	↗	↖	↗
Volume (vph)	105	5	10	15	30	1085	60	765
Turn Type	Perm		Perm		Perm		Perm	
Protected Phases		4		8		2		6
Permitted Phases	4		8		2		6	
Detector Phase	4	4	8	8	2	2	6	6
Switch Phase								
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	20.0	20.0	20.0	24.0	24.0	24.0	24.0
Total Split (s)	20.0	20.0	20.0	20.0	24.0	24.0	24.0	24.0
Total Split (%)	45.5%	45.5%	45.5%	45.5%	54.5%	54.5%	54.5%	54.5%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode	None	None	None	None	Min	Min	Min	Min
Act Effct Green (s)		9.0		9.0	23.6	23.6	23.6	23.6
Actuated g/C Ratio		0.23		0.23	0.61	0.61	0.61	0.61
v/c Ratio		0.45		0.20	0.10	0.55	0.30	0.43
Control Delay		15.3		9.5	7.2	8.4	12.4	7.0
Queue Delay		0.0		0.0	0.0	0.0	0.0	0.0
Total Delay		15.3		9.5	7.2	8.4	12.4	7.0
LOS		B		A	A	A	B	A
Approach Delay		15.3		9.5		8.4		7.3
Approach LOS		B		A		A		A

Intersection Summary













Cycle Length: 44	
Actuated Cycle Length: 38.8	
Natural Cycle: 50	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 0.55	
Intersection Signal Delay: 8.4	Intersection LOS: A
Intersection Capacity Utilization 60.4%	ICU Level of Service B
Analysis Period (min) 15	

Splits and Phases: 10: Grand Wailea Resort & Wailea Alanui Dr.



HCM Signalized Intersection Capacity Analysis
 10: Grand Wailea Resort & Wailea Alanui Dr.

Austin, Tsutsumi & Associates, Inc.
 7/31/2009

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations		↕			↕		↗	↕		↗	↕		
Volume (vph)	105	5	25	10	15	45	30	1085	10	60	765	70	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)		5.0			5.0		5.0	5.0		5.0	5.0		
Lane Util. Factor		1.00			1.00		1.00	0.95		1.00	0.95		
Flt Protected		0.98			0.91		1.00	1.00		1.00	0.99		
Flt Permitted		0.96			0.99		0.95	1.00		0.95	1.00		
Satd. Flow (prot)		1748			1688		1770	3534		1770	3495		
Satd. Flow (perm)		1313			1582		549	3534		355	3495		
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)	114	5	27	11	16	49	33	1179	11	65	832	76	
RTOR Reduction (vph)	0	22	0	0	22	0	0	1	0	0	12	0	
Lane Group Flow (vph)	0	124	0	0	54	0	33	1189	0	65	896	0	
Turn Type	Perm			Perm			Perm			Perm			
Protected Phases		4			8			2			6		
Permitted Phases	4			8			2			6			
Actuated Green, G (s)		7.6			7.6		22.3	22.3		22.3	22.3		
Effective Green, g (s)		7.6			7.6		22.3	22.3		22.3	22.3		
Actuated g/C Ratio		0.19			0.19		0.56	0.56		0.56	0.56		
Clearance Time (s)		5.0			5.0		5.0	5.0		5.0	5.0		
Vehicle Extension (s)		3.0			3.0		3.0	3.0		3.0	3.0		
Lane Grp Cap (vph)		250			301		307	1975		198	1953		
v/s Ratio Prot								c0.34			0.26		
v/s Ratio Perm		c0.09			0.03		0.06			0.18			
v/c Ratio		0.50			0.18		0.11	0.60		0.33	0.46		
Uniform Delay, d1		14.4			13.5		4.1	5.8		4.8	5.2		
Progression Factor		1.00			1.00		1.00	1.00		1.00	1.00		
Incremental Delay, d2		1.6			0.3		0.2	0.5		1.0	0.2		
Delay (s)		16.0			13.8		4.3	6.4		5.7	5.4		
Level of Service		B			B		A	A		A	A		
Approach Delay (s)		16.0			13.8			6.3			5.4		
Approach LOS		B			B			A			A		
Intersection Summary													
HCM Average Control Delay			6.8									HCM Level of Service	A
HCM Volume to Capacity ratio			0.58										
Actuated Cycle Length (s)			39.9									Sum of lost time (s)	10.0
Intersection Capacity Utilization			60.4%									ICU Level of Service	B
Analysis Period (min)			15										
c Critical Lane Group													

HCM Unsignalized Intersection Capacity Analysis
 11: Kaukahi Dr & Wailea Alanui Dr.

Austin, Tsutsumi & Associates, Inc.
 7/31/2009

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	95	25	10	85	15	5	10	740	100	35	625	65
Sign Control		Stop			Stop			Free			Free	
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)	103	27	11	92	16	5	11	804	109	38	679	71
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	1590	1582	679	1606	1652	804	750			804		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1590	1582	679	1606	1652	804	750			804		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	0	73	98	0	82	99	99			95		
cM capacity (veh/h)	71	102	451	63	93	383	859			820		
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2	SB 1	SB 2	SB 3			
Volume Total	103	38	109	5	815	109	38	679	71			
Volume Left	103	0	92	0	11	0	38	0	0			
Volume Right	0	11	0	5	0	109	0	0	71			
cSH	71	131	66	383	859	1700	820	1700	1700			
Volume to Capacity	1.46	0.29	1.64	0.01	0.01	0.06	0.05	0.40	0.04			
Queue Length 95th (ft)	214	28	240	1	1	0	4	0	0			
Control Delay (s)	367.9	43.2	452.2	14.5	0.3	0.0	9.6	0.0	0.0			
Lane LOS	F	E	F	B	A		A					
Approach Delay (s)	280.5		431.4		0.3		0.5					
Approach LOS	F		F									
Intersection Summary												
Average Delay			45.5									
Intersection Capacity Utilization			65.8%		ICU Level of Service					C		
Analysis Period (min)			15									

Timings

11: Kaukahi Dr & Wailea Alanui Dr.

7/31/2009



Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations										
Volume (vph)	30	20	90	30	5	345	50	20	590	145
Turn Type	Perm		Perm		Perm		Perm	Perm		Perm
Protected Phases		4		8		2			6	
Permitted Phases	4		8		2		2	6		6
Detector Phase	4	4	8	8	2	2	2	6	6	6
Switch Phase										
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0
Total Split (s)	24.0	24.0	24.0	24.0	36.0	36.0	36.0	36.0	36.0	36.0
Total Split (%)	40.0%	40.0%	40.0%	40.0%	60.0%	60.0%	60.0%	60.0%	60.0%	60.0%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag										
Lead-Lag Optimize?										
Recall Mode	None	None	None	None	Min	Min	Min	Min	Min	Min

Intersection Summary

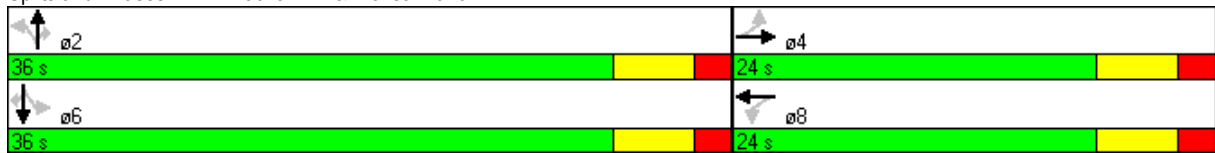
Cycle Length: 60

Actuated Cycle Length: 43.5

Natural Cycle: 60

Control Type: Actuated-Uncoordinated

Splits and Phases: 11: Kaukahi Dr & Wailea Alanui Dr.



HCM Signalized Intersection Capacity Analysis
 11: Kaukahi Dr & Wailea Alanui Dr.

7/31/2009

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	30	20	5	90	30	35	5	345	50	20	590	145
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0		6.0	6.0			6.0	6.0	6.0	6.0	6.0
Lane Util. Factor	1.00	1.00		1.00	1.00			1.00	1.00	1.00	1.00	1.00
Flt Protected	1.00	0.97		1.00	0.92			1.00	0.85	1.00	1.00	0.85
Flt Permitted	0.95	1.00		0.95	1.00			1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	1811		1770	1713			1862	1583	1770	1863	1583
Satd. Flow (perm)	1324	1811		1378	1713			1848	1583	999	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)	33	22	5	98	33	38	5	375	54	22	641	158
RTOR Reduction (vph)	0	4	0	0	32	0	0	0	23	0	0	68
Lane Group Flow (vph)	33	23	0	98	39	0	0	380	31	22	641	90
Turn Type	Perm			Perm			Perm		Perm	Perm	Perm	Perm
Protected Phases	4			8			2		2	6	6	6
Permitted Phases	4			8			2		2	6		6
Actuated Green, G (s)	7.2	7.2		7.2	7.2			25.6	25.6	25.6	25.6	25.6
Effective Green, g (s)	7.2	7.2		7.2	7.2			25.6	25.6	25.6	25.6	25.6
Actuated g/C Ratio	0.16	0.16		0.16	0.16			0.57	0.57	0.57	0.57	0.57
Clearance Time (s)	6.0	6.0		6.0	6.0			6.0	6.0	6.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	213	291		221	275			1056	905	571	1065	905
v/s Ratio Prot		0.01			0.02						c0.34	
v/s Ratio Perm	0.02			c0.07				0.21	0.02	0.02		0.06
v/c Ratio	0.15	0.08		0.44	0.14			0.36	0.03	0.04	0.60	0.10
Uniform Delay, d1	16.2	16.0		17.0	16.1			5.2	4.2	4.2	6.3	4.4
Progression Factor	1.00	1.00		1.00	1.00			1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.3	0.1		1.4	0.2			0.2	0.0	0.0	1.0	0.0
Delay (s)	16.5	16.1		18.4	16.4			5.4	4.2	4.2	7.2	4.4
Level of Service	B	B		B	B			A	A	A	A	A
Approach Delay (s)	16.3			17.6				5.2			6.6	
Approach LOS	B			B				A			A	
Intersection Summary												
HCM Average Control Delay	7.9			HCM Level of Service				A				
HCM Volume to Capacity ratio	0.57											
Actuated Cycle Length (s)	44.8			Sum of lost time (s)				12.0				
Intersection Capacity Utilization	52.7%			ICU Level of Service				A				
Analysis Period (min)	15											
c Critical Lane Group												

Timings

11: Kaukahi Dr & Wailea Alanui Dr.

7/31/2009



Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations										
Volume (vph)	95	25	85	15	10	740	100	35	625	65
Turn Type	Perm		Perm		Perm		Perm	Perm		Perm
Protected Phases		4		8		2			6	
Permitted Phases	4		8		2		2	6		6
Detector Phase	4	4	8	8	2	2	2	6	6	6
Switch Phase										
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0
Total Split (s)	24.0	24.0	24.0	24.0	36.0	36.0	36.0	36.0	36.0	36.0
Total Split (%)	40.0%	40.0%	40.0%	40.0%	60.0%	60.0%	60.0%	60.0%	60.0%	60.0%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag										
Lead-Lag Optimize?										
Recall Mode	None	None	None	None	Min	Min	Min	Min	Min	Min

Intersection Summary

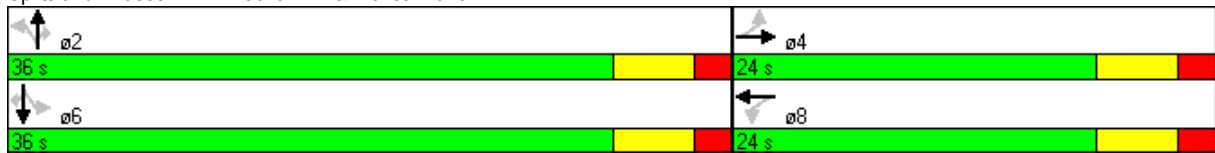
Cycle Length: 60

Actuated Cycle Length: 48.9

Natural Cycle: 60

Control Type: Actuated-Uncoordinated

Splits and Phases: 11: Kaukahi Dr & Wailea Alanui Dr.



HCM Signalized Intersection Capacity Analysis
 11: Kaukahi Dr & Wailea Alanui Dr.

7/31/2009

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗		↖	↗			↖	↗	↖	↗	↖
Volume (vph)	95	25	10	85	15	5	10	740	100	35	625	65
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0		6.0	6.0			6.0	6.0	6.0	6.0	6.0
Lane Util. Factor	1.00	1.00		1.00	1.00			1.00	1.00	1.00	1.00	1.00
Flt Protected	1.00	0.96		1.00	0.96			1.00	0.85	1.00	1.00	0.85
Flt Permitted	0.95	1.00		0.95	1.00			1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	1782		1770	1796			1861	1583	1770	1863	1583
Satd. Flow (perm)	1385	1782		1364	1796			1844	1583	447	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)	103	27	11	92	16	5	11	804	109	38	679	71
RTOR Reduction (vph)	0	9	0	0	4	0	0	0	31	0	0	28
Lane Group Flow (vph)	103	29	0	92	17	0	0	815	78	38	679	43
Turn Type	Perm			Perm			Perm		Perm	Perm	Perm	Perm
Protected Phases	4			8			2		2	6	6	6
Permitted Phases	4			8			2		2	6		6
Actuated Green, G (s)	7.5	7.5		7.5	7.5			30.7	30.7	30.7	30.7	30.7
Effective Green, g (s)	7.5	7.5		7.5	7.5			30.7	30.7	30.7	30.7	30.7
Actuated g/C Ratio	0.15	0.15		0.15	0.15			0.61	0.61	0.61	0.61	0.61
Clearance Time (s)	6.0	6.0		6.0	6.0			6.0	6.0	6.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	207	266		204	268			1128	968	273	1139	968
v/s Ratio Prot		0.02			0.01						0.36	
v/s Ratio Perm	c0.07			0.07				c0.44	0.05	0.08		0.03
v/c Ratio	0.50	0.11		0.45	0.06			0.72	0.08	0.14	0.60	0.04
Uniform Delay, d1	19.6	18.5		19.5	18.3			6.8	4.0	4.1	6.0	3.9
Progression Factor	1.00	1.00		1.00	1.00			1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.9	0.2		1.6	0.1			2.3	0.0	0.2	0.8	0.0
Delay (s)	21.5	18.6		21.1	18.4			9.1	4.0	4.4	6.8	3.9
Level of Service	C	B		C	B			A	A	A	A	A
Approach Delay (s)	20.7			20.6				8.5			6.4	
Approach LOS	C			C				A			A	
Intersection Summary												
HCM Average Control Delay	9.2			HCM Level of Service				A				
HCM Volume to Capacity ratio	0.68											
Actuated Cycle Length (s)	50.2			Sum of lost time (s)				12.0				
Intersection Capacity Utilization	68.9%			ICU Level of Service				C				
Analysis Period (min)	15											
c Critical Lane Group												



APPENDIX C

LEVEL OF SERVICE CALCULATIONS

- Project Accesses Along Piilani Highway Extension
-

HCM Unsignalized Intersection Capacity Analysis
 1: North Access & Piilani Highway Extension

Austin, Tsutsumi & Associate, Inc.
 11/10/2009



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	40	10	5	90	75	10
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	43	11	5	98	82	11
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type						
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	196	87	92			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	196	87	92			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	94	99	100			
cM capacity (veh/h)	790	972	1502			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1
Volume Total	54	5	98	92
Volume Left	43	5	0	0
Volume Right	11	0	0	11
cSH	821	1502	1700	1700
Volume to Capacity	0.07	0.00	0.06	0.05
Queue Length 95th (ft)	5	0	0	0
Control Delay (s)	9.7	7.4	0.0	0.0
Lane LOS	A	A		
Approach Delay (s)	9.7	0.4		0.0
Approach LOS	A			

Intersection Summary			
Average Delay		2.3	
Intersection Capacity Utilization		14.7%	ICU Level of Service A
Analysis Period (min)		15	

HCM Unsignalized Intersection Capacity Analysis
 2: Fire Station Driveway & Piilani Highway Extension

Austin, Tsutsumi & Associate, Inc.
 11/10/2009



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↔		↔		↔	↔
Volume (veh/h)	5	5	90	5	5	80
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	5	5	98	5	5	87
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type						
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	198	101			103	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	198	101			103	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	99	99			100	
cM capacity (veh/h)	787	955			1489	

Direction, Lane #	WB 1	NB 1	SB 1	SB 2
Volume Total	11	103	5	87
Volume Left	5	0	5	0
Volume Right	5	5	0	0
cSH	863	1700	1489	1700
Volume to Capacity	0.01	0.06	0.00	0.05
Queue Length 95th (ft)	1	0	0	0
Control Delay (s)	9.2	0.0	7.4	0.0
Lane LOS	A		A	
Approach Delay (s)	9.2	0.0	0.4	
Approach LOS	A			

Intersection Summary			
Average Delay		0.7	
Intersection Capacity Utilization		15.0%	ICU Level of Service A
Analysis Period (min)		15	

HCM Unsignalized Intersection Capacity Analysis
3: Mid Access & Piilani Highway Extension

Austin, Tsutsumi & Associate, Inc.
11/10/2009



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	25	10	5	70	75	10
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	27	11	5	76	82	11
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type						
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	174	87	92			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	174	87	92			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	97	99	100			
cM capacity (veh/h)	813	972	1502			
Direction, Lane #	EB 1	NB 1	NB 2	SB 1		
Volume Total	38	5	76	92		
Volume Left	27	5	0	0		
Volume Right	11	0	0	11		
cSH	853	1502	1700	1700		
Volume to Capacity	0.04	0.00	0.04	0.05		
Queue Length 95th (ft)	3	0	0	0		
Control Delay (s)	9.4	7.4	0.0	0.0		
Lane LOS	A	A				
Approach Delay (s)	9.4	0.5		0.0		
Approach LOS	A					
Intersection Summary						
Average Delay			1.9			
Intersection Capacity Utilization			14.6%		ICU Level of Service	A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis
 4: Kaukahi Street Extension & Piilani Highway Extension

Austin, Tsutsumi & Associate, Inc.
 11/10/2009





















Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	35	15	15	40	35	50
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	38	16	16	43	38	54
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	141	65	92			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	141	65	92			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	95	98	99			
cM capacity (veh/h)	842	999	1502			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1
Volume Total	54	16	43	92
Volume Left	38	16	0	0
Volume Right	16	0	0	54
cSH	884	1502	1700	1700
Volume to Capacity	0.06	0.01	0.03	0.05
Queue Length 95th (ft)	5	1	0	0
Control Delay (s)	9.3	7.4	0.0	0.0
Lane LOS	A	A		
Approach Delay (s)	9.3	2.0		0.0
Approach LOS	A			

Intersection Summary			
Average Delay		3.0	
Intersection Capacity Utilization		17.5%	ICU Level of Service A
Analysis Period (min)		15	

HCM Unsignalized Intersection Capacity Analysis
5: South Access & Piilani Highway Extension

Austin, Tsutsumi & Associate, Inc.
11/10/2009

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	35	5	5	5	5	10	5	10	5	15	10	25
Sign Control		Stop			Stop			Free			Free	
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)	38	5	5	5	5	11	5	11	5	16	11	27
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	92	84	24	76	95	14	38			16		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	92	84	24	76	95	14	38			16		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	96	99	99	99	99	99	100			99		
cM capacity (veh/h)	869	795	1052	895	784	1066	1572			1601		
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2						
Volume Total	49	22	5	16	16	38						
Volume Left	38	5	5	0	16	0						
Volume Right	5	11	0	5	0	27						
cSH	877	937	1572	1700	1601	1700						
Volume to Capacity	0.06	0.02	0.00	0.01	0.01	0.02						
Queue Length 95th (ft)	4	2	0	0	1	0						
Control Delay (s)	9.3	8.9	7.3	0.0	7.3	0.0						
Lane LOS	A	A	A		A							
Approach Delay (s)	9.3	8.9	1.8		2.2							
Approach LOS	A	A										
Intersection Summary												
Average Delay			5.5									
Intersection Capacity Utilization			20.7%		ICU Level of Service					A		
Analysis Period (min)			15									

HCM Unsignalized Intersection Capacity Analysis
 1: North Access & Piilani Highway Extension

Austin, Tsutsumi & Associate, Inc.
 11/10/2009



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	40	10	10	115	125	30
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	43	11	11	125	136	33
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type						
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	299	152	168			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	299	152	168			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	94	99	99			
cM capacity (veh/h)	687	894	1409			
Direction, Lane #	EB 1	NB 1	NB 2	SB 1		
Volume Total	54	11	125	168		
Volume Left	43	11	0	0		
Volume Right	11	0	0	33		
cSH	720	1409	1700	1700		
Volume to Capacity	0.08	0.01	0.07	0.10		
Queue Length 95th (ft)	6	1	0	0		
Control Delay (s)	10.4	7.6	0.0	0.0		
Lane LOS	B	A				
Approach Delay (s)	10.4	0.6		0.0		
Approach LOS	B					
Intersection Summary						
Average Delay			1.8			
Intersection Capacity Utilization			18.4%	ICU Level of Service	A	
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis
 2: Fire Station Driveway & Piilani Highway Extension

Austin, Tsutsumi & Associate, Inc.
 11/10/2009



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↔		↔		↔	↔
Volume (veh/h)	5	5	120	5	5	130
Sign Control	Stop		Free		Free	Free
Grade	0%		0%		0%	0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	5	5	130	5	5	141
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	285	133			136	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	285	133			136	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	99	99			100	
cM capacity (veh/h)	702	916			1448	

Direction, Lane #	WB 1	NB 1	SB 1	SB 2
Volume Total	11	136	5	141
Volume Left	5	0	5	0
Volume Right	5	5	0	0
cSH	795	1700	1448	1700
Volume to Capacity	0.01	0.08	0.00	0.08
Queue Length 95th (ft)	1	0	0	0
Control Delay (s)	9.6	0.0	7.5	0.0
Lane LOS	A		A	
Approach Delay (s)	9.6	0.0	0.3	
Approach LOS	A			

Intersection Summary			
Average Delay		0.5	
Intersection Capacity Utilization		16.8%	ICU Level of Service A
Analysis Period (min)		15	

HCM Unsignalized Intersection Capacity Analysis
 3: Mid Access & Piilani Highway Extension

Austin, Tsutsumi & Associate, Inc.
 11/10/2009



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↔		↔	↑	↑	
Volume (veh/h)	25	10	10	115	110	25
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	27	11	11	125	120	27
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	280	133	147			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	280	133	147			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	96	99	99			
cM capacity (veh/h)	705	916	1435			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1
Volume Total	38	11	125	147
Volume Left	27	11	0	0
Volume Right	11	0	0	27
cSH	754	1435	1700	1700
Volume to Capacity	0.05	0.01	0.07	0.09
Queue Length 95th (ft)	4	1	0	0
Control Delay (s)	10.0	7.5	0.0	0.0
Lane LOS	B	A		
Approach Delay (s)	10.0	0.6		0.0
Approach LOS	B			

Intersection Summary			
Average Delay		1.4	
Intersection Capacity Utilization		18.3%	ICU Level of Service A
Analysis Period (min)		15	

HCM Unsignalized Intersection Capacity Analysis
 4: Kauhahi Street Extension & Piilani Highway Extension

Austin, Tsutsumi & Associate, Inc.
 11/10/2009



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	50	15	25	75	65	55
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	54	16	27	82	71	60
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type						
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	236	101	130			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	236	101	130			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	93	98	98			
cM capacity (veh/h)	738	955	1455			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1
Volume Total	71	27	82	130
Volume Left	54	27	0	0
Volume Right	16	0	0	60
cSH	779	1455	1700	1700
Volume to Capacity	0.09	0.02	0.05	0.08
Queue Length 95th (ft)	7	1	0	0
Control Delay (s)	10.1	7.5	0.0	0.0
Lane LOS	B	A		
Approach Delay (s)	10.1	1.9		0.0
Approach LOS	B			

Intersection Summary			
Average Delay		3.0	
Intersection Capacity Utilization		18.4%	ICU Level of Service A
Analysis Period (min)		15	

HCM Unsignalized Intersection Capacity Analysis
5: South Access & Piilani Highway Extension

Austin, Tsutsumi & Associate, Inc.
11/10/2009

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕		↗	↖		↗	↖	
Volume (veh/h)	60	5	5	5	5	15	5	25	5	10	30	40
Sign Control		Stop			Stop			Free			Free	
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)	65	5	5	5	5	16	5	27	5	11	33	43
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	133	120	54	103	139	30	76			33		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	133	120	54	103	139	30	76			33		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	92	99	99	99	99	98	100			99		
cM capacity (veh/h)	814	763	1013	861	745	1045	1523			1579		
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2						
Volume Total	76	27	5	33	11	76						
Volume Left	65	5	5	0	11	0						
Volume Right	5	16	0	5	0	43						
cSH	822	930	1523	1700	1579	1700						
Volume to Capacity	0.09	0.03	0.00	0.02	0.01	0.04						
Queue Length 95th (ft)	8	2	0	0	1	0						
Control Delay (s)	9.8	9.0	7.4	0.0	7.3	0.0						
Lane LOS	A	A	A		A							
Approach Delay (s)	9.8	9.0	1.1		0.9							
Approach LOS	A	A										
Intersection Summary												
Average Delay			4.9									
Intersection Capacity Utilization			24.4%		ICU Level of Service					A		
Analysis Period (min)			15									

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*****
*
* 10:11:09          08+048 PIILANI EXT+NORTH ACCESS FY 2022          11
*
*****
*
* E      (m)      5.00   5.00   5.00          * TIME PERIOD      min      90
* L'     (m)     10.00  10.00  10.00        * TIME SLICE       min      15
* V      (m)      3.70   3.70   3.70        * RESULTS PERIOD  min     15 75
* RAD    (m)     20.00  20.00  20.00        * TIME COST        $/hr    15.00
* PHI    (d)     30.00  30.00  30.00        * FLOW PERIOD      min     15 75
* DIA    (m)     37.00  37.00  37.00        * FLOW TYPE        pcu/veh   VEH
* GRAD SEP      0       0       0          * FLOW PEAK        am/op/pm   AM
*
*****
* LEG NAME *PCU *FLOWS (1st exit 2nd etc...U)*FLOF*CL* FLOW RATIO *FLOW TIME*
*          *   *
*SB PII   *1.05*  10   75   0          *1.00*75*0.75 1.125 0.75*15 45 75
*NB PII   *1.05*  90   5   0          *1.00*75*0.75 1.125 0.75*15 45 75
*EB NA    *1.05*  10  40   0          *1.00*75*0.75 1.125 0.75*15 45 75
*          *   *
*          *   *
*          *   *
*          *   *
*****
*
* FLOW      veh      85      95      50          *
* CAPACITY  veh     1181    1160    1201        * AVDEL s          3.2
* AVE DELAY mins    0.05    0.06    0.05        * L O S           A
* MAX DELAY mins    0.07    0.07    0.06        * VEH HRS         0.2
* AVE QUEUE  veh      0       0       0          * COST $          3.1
* MAX QUEUE  veh      0       0       0          *
*
*****

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*****
*
* 10:11:09          08+048 PIILANI EXT+NORTH ACCESS FY 2022          10
*
*****
*
* E      (m)      5.00   5.00   5.00          * TIME PERIOD      min      90
* L'     (m)     10.00  10.00  10.00         * TIME SLICE       min      15
* V      (m)      3.70   3.70   3.70         * RESULTS PERIOD   min     15 75
* RAD    (m)     20.00  20.00  20.00         * TIME COST        $/hr   15.00
* PHI    (d)     30.00  30.00  30.00         * FLOW PERIOD      min     15 75
* DIA    (m)     37.00  37.00  37.00         * FLOW TYPE        pcu/veh  VEH
* GRAD SEP      0       0       0           * FLOW PEAK        am/op/pm  PM
*
*****
* LEG NAME *PCU *FLOWS (1st exit 2nd etc...U)*FLOF*CL* FLOW RATIO *FLOW TIME*
*          *   *
*SB PII    *1.05*  30  125   0           *1.00*75*0.75 1.125 0.75*15 45 75
*NB PII    *1.05* 115   10   0           *1.00*75*0.75 1.125 0.75*15 45 75
*EB NA     *1.05*  10   40   0           *1.00*75*0.75 1.125 0.75*15 45 75
*          *   *
*          *   *
*          *   *
*          *   *
*****
*
* FLOW      veh      155   125   50          *
* CAPACITY  veh     1181  1131  1198         * AVDEL s          3.4
* AVE DELAY mins    0.06  0.06  0.05         * L O S            A
* MAX DELAY mins    0.07  0.07  0.06         * VEH HRS          0.3
* AVE QUEUE  veh      0       0       0           * COST $           4.7
* MAX QUEUE  veh      0       0       0           *
*
*****

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*****
*
* 19:11:09          08+048 PIILANI EXT+fire station FY 2022          15 *
*
*****
*
* E      (m)      5.00   5.00   5.00          * TIME PERIOD      min      90 *
* L'    (m)     10.00  10.00  10.00        * TIME SLICE       min      15 *
* V      (m)      3.70   3.70   3.70        * RESULTS PERIOD   min     15 75 *
* RAD   (m)     20.00  20.00  20.00        * TIME COST        $/hr    15.00 *
* PHI   (d)     30.00  30.00  30.00        * FLOW PERIOD      min     15 75 *
* DIA   (m)     37.00  37.00  37.00        * FLOW TYPE        pcu/veh   VEH *
* GRAD SEP      0      0      0          * FLOW PEAK        am/op/pm   AM *
*
*****
* LEG NAME *PCU *FLOWS (1st exit 2nd etc...U)*FLOF*CL* FLOW RATIO *FLOW TIME*
*          *   *
*SB PII   *1.05*  75   5   0          *1.00*75*0.75 1.125 0.75*15 45 75 *
*WB FS    *1.05*   5   5   0          *1.00*75*0.75 1.125 0.75*15 45 75 *
*NB PII   *1.05*   5  90   0          *1.00*75*0.75 1.125 0.75*15 45 75 *
*          *   *
*          *   *
*          *   *
*          *   *
*****
*
* FLOW      veh      80      10      95          *
* CAPACITY  veh     1151    1201    1201        * AVDEL s        3.2 *
* AVE DELAY mins    0.05    0.05    0.05        * L O S          A *
* MAX DELAY mins    0.07    0.06    0.07        * VEH HRS        0.2 *
* AVE QUEUE  veh      0      0      0          * COST $         2.5 *
* MAX QUEUE  veh      0      0      0          *
*
*****

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*****
*
* 19:11:09          08+048 PIILANI EXT+fire station FY 2022          16
*
*****
*
* E      (m)      5.00   5.00   5.00          * TIME PERIOD      min      90
* L'     (m)     10.00  10.00  10.00         * TIME SLICE       min      15
* V      (m)      3.70   3.70   3.70         * RESULTS PERIOD   min     15 75
* RAD    (m)     20.00  20.00  20.00         * TIME COST        $/hr    15.00
* PHI    (d)     30.00  30.00  30.00         * FLOW PERIOD      min     15 75
* DIA    (m)     37.00  37.00  37.00         * FLOW TYPE        pcu/veh   VEH
* GRAD SEP      0       0       0           * FLOW PEAK        am/op/pm   PM
*
*****
* LEG NAME *PCU *FLOWS (1st exit 2nd etc...U)*FLOF*CL* FLOW RATIO *FLOW TIME*
*          *   *
*SB PII    *1.05* 125   5   0           *1.00*75*0.75 1.125 0.75*15 45 75
*wB FS     *1.05*   5   5   0           *1.00*75*0.75 1.125 0.75*15 45 75
*NB PII    *1.05*   5 115  0           *1.00*75*0.75 1.125 0.75*15 45 75
*          *   *
*          *   *
*          *   *
*          *   *
*****
*
* FLOW      veh      130      10      120          *
* CAPACITY  veh     1137     1201     1201         * AVDEL s      3.4
* AVE DELAY mins    0.06    0.05    0.05         * L O S        A
* MAX DELAY mins    0.07    0.06    0.07         * VEH HRS      0.2
* AVE QUEUE  veh      0       0       0           * COST $       3.6
* MAX QUEUE  veh      0       0       0           *
*
*****

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*****
*
* 10:11:09          08+048 PIILANI EXT+ Mid ACCESS FY 2022          8
*
*****
*
* E      (m)      5.00   5.00   5.00          * TIME PERIOD      min      90
* L'     (m)     10.00  10.00  10.00          * TIME SLICE       min      15
* V      (m)      3.70   3.70   3.70          * RESULTS PERIOD   min     15 75
* RAD    (m)     20.00  20.00  20.00          * TIME COST        $/hr    15.00
* PHI    (d)     30.00  30.00  30.00          * FLOW PERIOD      min     15 75
* DIA    (m)     37.00  37.00  37.00          * FLOW TYPE        pcu/veh  VEH
* GRAD SEP      0       0       0          * FLOW PEAK        am/op/pm  AM
*
*****
* LEG NAME *PCU *FLOWS (1st exit 2nd etc...U)*FLOF*CL* FLOW RATIO *FLOW TIME*
*          *   *
*SB PII    *1.05*  10   75   0          *1.00*75*0.75  1.125  0.75*15 45 75
*NB PII    *1.05*  70   5   0          *1.00*75*0.75  1.125  0.75*15 45 75
*eB NA     *1.05*  10   25  0          *1.00*75*0.75  1.125  0.75*15 45 75
*          *   *
*          *   *
*          *   *
*          *   *
*****
*
* FLOW      veh      85      75      35          *
* CAPACITY  veh     1189   1160   1201          * AVDEL s      3.2
* AVE DELAY mins    0.05   0.05   0.05          * L O S       A
* MAX DELAY mins    0.07   0.07   0.06          * VEH HRS     0.2
* AVE QUEUE  veh      0       0       0          * COST $      2.6
* MAX QUEUE  veh      0       0       0
*
*****

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*****
*
* 10:11:09          08+048 PIILANI EXT+ Midr ACCESS FY 2022          9
*
*****
*
* E      (m)      5.00   5.00   5.00          * TIME PERIOD      min      90
* L'     (m)     10.00  10.00  10.00          * TIME SLICE       min      15
* V      (m)      3.70   3.70   3.70          * RESULTS PERIOD   min     15 75
* RAD    (m)     20.00  20.00  20.00          * TIME COST        $/hr    15.00
* PHI    (d)     30.00  30.00  30.00          * FLOW PERIOD      min     15 75
* DIA    (m)     37.00  37.00  37.00          * FLOW TYPE        pcu/veh  VEH
* GRAD SEP      0       0       0          * FLOW PEAK        am/op/pm  PM
*
*****
* LEG NAME *PCU *FLOWS (1st exit 2nd etc...U)*FLOF*CL* FLOW RATIO *FLOW TIME*
*          *   *
*SB PII    *1.05*  25  110   0          *1.00*75*0.75  1.125  0.75*15 45 75
*NB PII    *1.05*  115  10   0          *1.00*75*0.75  1.125  0.75*15 45 75
*eB NA     *1.05*  10  25   0          *1.00*75*0.75  1.125  0.75*15 45 75
*          *   *
*          *   *
*          *   *
*          *   *
*****
*
* FLOW      veh      135   125   35          *
* CAPACITY  veh     1189  1139  1198          * AVDEL s      3.4
* AVE DELAY mins   0.06  0.06  0.05          * L O S       A
* MAX DELAY mins   0.07  0.07  0.06          * VEH HRS     0.3
* AVE QUEUE  veh      0     0     0          * COST $      4.1
* MAX QUEUE  veh      0     0     0
*
*****

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*****
*
* 10:11:09                08+048 PIILANI EXT+kaukahi fy 2022                11
*
*****
*
* E      (m)      5.00    5.00    5.00
* L'     (m)     10.00   10.00   10.00
* V      (m)      3.70    3.70    3.70
* RAD    (m)     20.00   20.00   20.00
* PHI    (d)     30.00   30.00   30.00
* DIA    (m)     37.00   37.00   37.00
* GRAD SEP      0        0        0
*
*
* TIME PERIOD      min      90
* TIME SLICE       min      15
* RESULTS PERIOD   min     15 75
* TIME COST        $/hr    15.00
* FLOW PERIOD      min     15 75
* FLOW TYPE        pcu/veh   VEH
* FLOW PEAK        am/op/pm  AM
*
*****
* LEG NAME *PCU *FLOWS (1st exit 2nd etc...U) *FLOF*CL* FLOW RATIO *FLOW TIME*
*
* SB PII *1.05* 50 35 0 *1.00*75*0.75 1.125 0.75*15 45 75
* NB PII *1.05* 40 15 0 *1.00*75*0.75 1.125 0.75*15 45 75
* EB NA *1.05* 15 35 0 *1.00*75*0.75 1.125 0.75*15 45 75
*
*
*
*
*
*
*****
*
* FLOW      veh      85      55      50
* CAPACITY  veh     1184    1184    1195
* AVE DELAY mins    0.05    0.05    0.05
* MAX DELAY mins    0.07    0.07    0.06
* AVE QUEUE  veh      0        0        0
* MAX QUEUE  veh      0        0        0
*
*
*
*****

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*****
*
* 10:11:09          08+048 PIILANI EXT+kaukahi fy 2022          10
*
*****
*
* E      (m)      5.00   5.00   5.00          * TIME PERIOD      min      90
* L'     (m)     10.00  10.00  10.00         * TIME SLICE       min      15
* V      (m)      3.70   3.70   3.70         * RESULTS PERIOD   min     15 75
* RAD    (m)     20.00  20.00  20.00         * TIME COST        $/hr    15.00
* PHI    (d)     30.00  30.00  30.00         * FLOW PERIOD      min     15 75
* DIA    (m)     37.00  37.00  37.00         * FLOW TYPE        pcu/veh   VEH
* GRAD SEP      0      0      0          * FLOW PEAK        am/op/pm   PM
*
*****
* LEG NAME *PCU *FLOWS (1st exit 2nd etc...U)*FLOF*CL* FLOW RATIO *FLOW TIME*
*          *   *
*SB PII   *1.05*  55   65   0          *1.00*75*0.75 1.125 0.75*15 45 75
*NB PII   *1.05*  75   25   0          *1.00*75*0.75 1.125 0.75*15 45 75
*EB NA    *1.05*  15   50   0          *1.00*75*0.75 1.125 0.75*15 45 75
*          *   *
*          *   *
*          *   *
*          *   *
*****
*
* FLOW      veh      120    100    65          *
* CAPACITY  veh      1175   1166   1189         * AVDEL s      3.3
* AVE DELAY mins    0.06   0.06   0.05         * L O S       A
* MAX DELAY mins    0.07   0.07   0.07         * VEH HRS     0.3
* AVE QUEUE  veh      0      0      0          * COST $      3.9
* MAX QUEUE  veh      0      0      0          *
*
*****

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*****
*
* 10:11:09          08-048 piilani ext-sothacces fy 2022          19
*
*****
*
* E      (m)      5.00   5.00   5.00   5.00      * TIME PERIOD      min      90
* L'     (m)     10.00  10.00  10.00  10.00     * TIME SLICE       min      15
* V      (m)      3.70   3.70   3.70   3.70     * RESULTS PERIOD   min     15 75
* RAD    (m)     20.00  20.00  20.00  20.00     * TIME COST        $/hr    15.00
* PHI    (d)     30.00  30.00  30.00  30.00     * FLOW PERIOD      min     15 75
* DIA    (m)     37.00  37.00  37.00  37.00     * FLOW TYPE        pcu/veh  VEH
* GRAD SEP      0      0      0      0      * FLOW PEAK        am/op/pm  AM
*
*****
* LEG NAME *PCU *FLOWS (1st exit 2nd etc...U)*FLOF*CL* FLOW RATIO *FLOW TIME*
*          *   *
*sb pii   *1.05*  25   10   15   0      *1.00*75*0.75 1.125 0.75*15 45 75
*wb sa    *1.05*  10    5    5   0      *1.00*75*0.75 1.125 0.75*15 45 75
*nb pii   *1.05*   5   10    5   0      *1.00*75*0.75 1.125 0.75*15 45 75
*eb sa    *1.05*   5    5   35   0     *1.00*75*0.75 1.125 0.75*15 45 75
*          *   *
*          *   *
*          *   *
*****
*
* FLOW      veh      50      20      20      45
* CAPACITY  veh     1178    1169    1189    1192
* AVE DELAY mins    0.05    0.05    0.05    0.05
* MAX DELAY mins    0.07    0.06    0.06    0.06
* AVE QUEUE  veh      0      0      0      0
* MAX QUEUE  veh      0      0      0      0
*
*****

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*****
*
* 10:11:09          08-048 piilani ext-South acces fy 2022          1
*
*****
*
* E      (m)      5.00   5.00   5.00   5.00          * TIME PERIOD      min      90
* L'     (m)     10.00  10.00  10.00  10.00          * TIME SLICE       min      15
* V      (m)      3.70   3.70   3.70   3.70          * RESULTS PERIOD   min     15 75
* RAD    (m)     20.00  20.00  20.00  20.00          * TIME COST        $/hr    15.00
* PHI    (d)     30.00  30.00  30.00  30.00          * FLOW PERIOD      min     15 75
* DIA    (m)     37.00  37.00  37.00  37.00          * FLOW TYPE        pcu/veh   VEH
* GRAD SEP      0      0      0      0          * FLOW PEAK        am/op/pm   PM
*
*****
* LEG NAME *PCU *FLOWS (1st exit 2nd etc...U)*FLOF*CL* FLOW RATIO *FLOW TIME*
*          *   *
*sb pii   *1.05*  40   30   10   0          *1.00*75*0.75 1.125 0.75*15 45 75 *
*wb sa    *1.05*  15    5    5   0          *1.00*75*0.75 1.125 0.75*15 45 75 *
*nb pii   *1.05*   5   25    5   0          *1.00*75*0.75 1.125 0.75*15 45 75 *
*eb sa    *1.05*   5    5   60   0          *1.00*75*0.75 1.125 0.75*15 45 75 *
*          *   *
*          *   *
*          *   *
*****
*
* FLOW          veh          80      25      35      70
* CAPACITY     veh        1163    1145    1192    1184          * AVDEL s          3.2
* AVE DELAY    mins         0.05    0.05    0.05    0.05          * L O S            A
* MAX DELAY    mins         0.07    0.07    0.06    0.07          * VEH HRS          0.2
* AVE QUEUE    veh           0        0        0        0          * COST $           2.8
* MAX QUEUE    veh           0        0        0        0
*
*****

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AUSTIN, TSUTSUMI & ASSOCIATES, INC.
CIVIL ENGINEERS • SURVEYORS

APPENDIX D

LEVEL OF SERVICE SUMMARY TABLE

v/c Ratio	Existing 2008			Base Year 2016 without Project without Mitigative Measures			Base Year 2016 without Project with Recommended Mitigative Measures			Future Year 21 No Mitigative Meas			
	AM		PM	AM		PM	AM		PM	AM		PM	
	LOS	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS
0.59	C	36.7	0.59	D	45	0.75	D	46.3	D	51.4	0.74	D	D
0.11	C	30.5	0.14	C	29.3	0.12	C	21.9	C	36.1	0.12	D	D
0.26	C	30.6	0.15	C	29.4	0.13	C	-	C	-	-	-	-
-	-	-	-	-	-	-	-	21.9	-	35.5	0.04	D	D
0.1	C	30.2	0.09	C	29.1	0.09	C	21.9	C	35.9	0.09	D	D
0.06	C	36.1	0.08	D	38.7	0.18	D	22	C	35.9	0.09	D	D
-	-	-	-	-	-	-	-	30.7	C	49.3	0.22	D	D
0.28	A	27.1	0.88	C	270.1	1.54	F	8.5	A	22.4	0.77	C	B
-	-	-	-	-	-	-	-	6.2	A	11.4	0.01	-	-
0.46	C	43.3	0.71	D	48	0.74	D	28.4	C	51.9	0.7	B	D
0.69	A	11.2	0.53	B	82.6	1.11	F	9.3	A	11.6	0.55	B	B
0.08	A	6.9	0.09	A	8.8	0.18	A	5.4	A	8.4	0.16	A	A
0.68	B	23.6	0.8	C	147.9	1.34	F	12.6	B	21.8	0.75	C	B
-	-	-	-	-	-	-	-	-	-	-	-	-	-
0.18	C	141.7	0.95	F	51.1	0.85	D	21.8	C	39.3	0.8	D	C
-	-	-	-	-	-	-	-	16	B	22.8	0.11	-	C
0.26	C	27.7	0.26	D	27.5	0.12	C	-	-	-	-	-	-
0	-	-	-	-	20.2	0.13	C	16.8	-	22.9	0.13	C	C
0.13	A	8.3	0.01	A	7.7	0.16	A	31.8	C	37.4	0.42	D	D
-	A	0	0.43	A	30	0.94	C	-	-	-	-	-	-
0.01	A	0	0.02	-	-	-	-	9.8	A	17.3	0.68	B	A
0.02	A	9.5	0.09	A	4.7	0.03	A	-	-	-	-	-	-
0.43	A	0	0.28	A	120.1	1.02	F	27.9	C	36.3	0.53	D	D
-	-	-	-	-	13.7	0.7	B	-	-	-	-	-	-
0.04	A	0	0.02	A	5	0.19	A	14.4	B	14.5	0.61	B	B
-	-	-	-	-	6.9	0.19	-	14.5	B	19.5	0.75	B	B
To be constructed with Project only													
0.04	A	0	0.14	A	0	0.27	A	0	A	0	0.27	A	A
0.09	A	9.4	0.08	A	12.9	0.21	B	8.8	A	12.9	0.21	B	A
0.21	A	0	0.13	A	0	0.23	A	0	A	0	0.23	A	A
0.02	C	23.6	0.05	C	326.3	1.26	F	42.6	E	326.3	1.26	F	F
0.04	A	12	0.21	B	17.8	0.37	C	10.2	B	17.8	0.37	C	B

PILANI HIGHWAY WIDENING												
To be constructed with Project only												
PILANI HIGHWAY WIDENING												
To be constructed with Project only												

v/c Ratio	Existing 2008				Base Year 2016 without Project without Mitigative Measures				Base Year 2016 without Project with Recommended Mitigative Measures				Future Year 21 No Mitigative Meas			
	AM		PM		AM		PM		AM		PM		AM		PM	
	LOS	HCM Delay	v/c Ratio	LOS	LOS	HCM Delay	v/c Ratio	LOS	LOS	HCM Delay	v/c Ratio	LOS	LOS	HCM Delay	v/c Ratio	LOS
0.76	B	17.8	0.68	B	27.3	0.88	C	C	27.3	0.88	C	C	32	0.83	C	C
0.08	A	11.9	0.09	B	10	0.15	A	B	10	0.15	A	B	17.2	0.15	B	B
0.34	B	16.1	0.59	B	47.4	0.65	D	D	47.4	0.65	D	D	38.1	0.84	D	B
0.11	A	0.6	0.36	A	0.3	0.2	A	A	0.3	0.2	A	A	1.2	0.51	A	B
0.57	C	27.3	0.68	C	47.8	0.62	D	D	47.8	0.62	D	D	40.3	0.77	D	A
0.23	B	6.3	0.15	A	27.6	0.39	C	C	27.6	0.39	C	C	10.2	0.22	D	D
0.63	B	10.8	0.64	B	25.1	0.8	C	B	25.1	0.8	C	B	19.9	0.82	B	A
Drive																
-	A	8	-	A	8.1	-	A	A	8.1	-	A	A	9.9	-	A	A
-	A	5.9	-	A	7.3	-	A	A	7.3	-	A	A	7.1	-	A	A
-	A	8.6	-	A	10.1	-	B	B	10.1	-	B	B	12.1	-	B	B
-	A	6.9	-	A	6.7	-	A	A	6.7	-	A	A	7.8	-	A	A
-	A	12	-	B	10.8	-	B	B	10.8	-	B	B	28.3	-	D	B
-	A	7.6	-	A	7.4	-	A	A	7.4	-	A	A	8.6	-	A	A
-	A	5.2	-	A	5.2	-	A	A	5.2	-	A	A	5.5	-	A	A
-	A	7.6	-	A	8.3	-	A	A	8.3	-	A	A	8.9	-	A	A
-	A	6.5	-	A	6.7	-	A	A	6.7	-	A	A	7.6	-	A	A
Drive																
0.07	A	12.3	0.2	B	11.4	0.14	B	C	11.4	0.14	B	C	18.6	0.31	C	B
0.08	A	12.3	0.2	B	11.4	0.14	B	C	11.4	0.14	B	C	18.6	0.31	C	B
0.07	A	0	0.21	A	0	0.17	A	A	0	0.17	A	A	0	0.34	A	A
0.06	A	2.1	0.06	A	2.1	0.08	A	A	2.1	0.08	A	A	2.7	0.11	A	A
Wailea																
0.33	C	16.1	0.35	B	17.6	0.33	B	B	18.3	0.33	B	B	16.2	0.5	B	B
0.06	B	14.8	0.11	B	16.7	0.17	B	B	17.4	0.17	B	B	13.8	0.12	B	B
0.01	A	2.5	0.02	A	2.4	0.06	A	A	3.1	0.07	A	A	5.1	0.09	A	A
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0.09	A	3.1	0.31	A	2.5	0.17	A	A	3.3	0.18	A	A	6.8	0.52	A	A
0.03	A	2.5	0.04	A	3.1	0.31	A	A	3.9	0.33	A	A	5.9	0.24	A	A
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0.29	A	2.8	0.2	A	3.2	0.43	A	A	4.2	0.46	A	A	6	0.37	A	A
0.29	A	3.9	0.31	A	4.1	0.42	A	A	4.9	0.45	A	A	7.5	0.52	A	A
ii Street																
-	-	-	-	-	-	-	-	-	19.6	0.12	C	F	59	0.62	F	C
0.09	B	17.7	0.31	C	19.1	0.19	C	F	15.4	0.07	C	C	22.8	0.16	C	C
-	-	-	-	-	-	-	-	-	19.1	0.16	C	E	36.4	0.22	E	C
0.13	B	15.7	0.1	C	22	0.28	C	E	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	15	0.16	C	C	24.1	0.1	C	C
0.03	A	10	0.01	A	9.7	0.05	A	B	-	-	-	-	0.3	-	-	-
0	A	0.2	0	A	0.3	0.01	A	A	0	0	A	A	0	0.01	A	A
0	A	0	0.02	A	0	0	A	A	0	0	A	A	0	0.03	A	A
0.02	A	7.9	0.02	A	7.7	0.02	A	A	7.7	0.02	A	A	8.8	0.04	A	A
0.13	A	0	0.13	A	0	0.27	A	A	0	0.27	A	A	0	0.27	A	A
0.09	A	0	0.04	A	0	0.09	A	A	0	0.09	A	A	0	0.04	A	A

Existing 2008			Base Year 2018 without Project No Mitigative Measures Recommended						Future Year 2018 with Project No Mitigative Measures Recommended							
AM		PM			AM			PM			AM			PM		
v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS
0.59	C	36.7	0.59	D	47.2	0.82	D	51.4	0.74	D	52.5	0.72	D	76.9	0.87	E
0.11	C	30.5	0.14	C	21.9	0.09	C	36.1	0.12	D	37.9	0.08	D	43.1	0.14	D
0.26	C	30.6	0.15	C	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	21.9	0.08	C	35.5	0.04	D	37.8	0.07	D	42.3	0.05	D
-	-	-	-	-	22	0.12	C	35.9	0.09	D	38.1	0.1	D	42.8	0.11	D
0.1	C	30.2	0.09	C	22	0.11	C	35.9	0.1	D	38.1	0.11	D	42.7	0.1	D
0.06	C	36.1	0.08	D	30.7	0.15	C	49.3	0.22	D	49	0.05	D	54.1	0.21	D
-	A	-	-	C	8.7	0.42	A	26.3	0.86	C	11.9	0.48	B	30.6	0.94	C
0.28	A	27.1	0.88	C	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	6.2	0	A	11.4	0.01	B	7.9	0	A	9.2	0.01	A
0.46	C	43.3	0.71	D	28.4	0.42	C	51.9	0.7	D	49	0.38	D	79.6	0.86	E
0.69	A	11.2	0.53	B	10.5	0.72	B	12.2	0.58	B	15.5	0.75	B	14.6	0.71	B
0.08	A	6.9	0.09	A	5.4	0.1	A	8.4	0.16	A	7.5	0.11	A	7.8	0.16	A
0.68	B	23.6	0.8	C	13.2	0.74	B	23.5	0.81	C	18	0.73	B	28	0.91	C
-	-	-	-	-	21.8	0.62	C	40	0.8	D	34.5	0.72	C	49.8	0.83	D
0.18	C	141.7	0.95	F	16	-	B	22.7	0.11	C	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0.26	C	27.7	0.26	D	-	-	-	-	-	-	21.9	0.06	C	27.6	0.11	C
0	A	8.3	0.01	A	16.8	0.21	B	22.8	0.13	C	23	0.22	C	27.7	0.13	C
0.13	A	0	0.43	A	31.8	0.33	C	37.4	0.42	D	42	0.37	D	48.8	0.52	D
-	-	-	-	-	10.1	0.35	B	19.9	0.78	B	10.4	0.42	B	28.9	0.92	C
0.01	A	0	0.02	A	-	-	-	-	-	-	-	-	-	-	-	-
0.02	A	9.5	0.09	A	27.9	0.43	C	36.3	0.53	D	38.6	0.51	D	50.7	0.63	D
0.43	A	0	0.28	A	17.8	0.85	B	15.3	0.66	B	17.4	0.84	B	20.6	0.82	C
0.04	A	0	0.02	A	-	-	-	-	-	-	-	-	-	-	-	-
0	A	11.9	0	B	16.5	0.7	B	20.8	0.82	C	17.3	0.75	B	27.6	0.92	C
To be constructed with Project only																
To be constructed with Project only																
To be constructed with Project only																
0.04	A	0	0.14	A	0	0.13	A	0	0.28	A	0	0.14	A	0	0.31	A
0.09	A	9.4	0.08	A	9.7	0.26	A	14.4	0.31	B	10.2	0.28	B	16.1	0.35	C
0.21	A	0	0.13	A	0	0.35	A	0	0.24	A	0	0.37	A	0	0.27	A
0.02	C	23.6	0.05	C	155.7	0.79	F	1013.7	2.76	F	236.6	0.98	F	Err	3.93	F
0.04	A	12	0.21	B	10.9	0.17	B	31	0.7	D	11.3	0.19	B	41.5	0.79	E

Existing 2008			Base Year 2018 without Project No Mitigative Measures Recommended						Future Year 2018 with Project No Mitigative Measures Recommended								
AM			PM			AM			PM			AM			PM		
v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS	
0.76	B	17.8	0.68	B	32.8	0.91	C	35.1	0.86	D	24.3	0.81	C	24.3	0.81	C	
0.08	A	11.9	0.09	B	10.9	0.17	B	17.6	0.18	B	15.2	0.15	B	15.2	0.15	B	
0.34	B	16.1	0.59	B	52.4	0.7	D	42.5	0.87	D	20.2	0.35	C	20.2	0.35	C	
0.11	A	0.6	0.36	A	0.3	0.21	A	1.3	0.53	A	2.8	0.14	A	2.8	0.14	A	
0.57	C	27.3	0.68	C	54.2	0.71	D	44.6	0.81	D	39	0.76	D	39	0.76	D	
0.23	B	6.3	0.15	A	28.6	0.39	C	10.6	0.22	B	9.6	0.26	A	9.6	0.26	A	
0.63	B	10.8	0.64	B	28.8	0.84	C	21.8	0.85	C	18.2	0.63	B	18.2	0.63	B	
Drive																	
-	A	8	-	A	8.2	-	A	10.2	-	B	8.2	-	A	10.4	-	B	
-	A	5.9	-	A	7.8	-	A	7.3	-	A	7.9	-	A	7.5	-	A	
-	A	8.6	-	A	10.3	-	B	12.5	-	B	10.4	-	B	12.7	-	B	
-	A	6.9	-	A	6.8	-	A	8	-	A	6.8	-	A	8.1	-	A	
-	A	12	-	B	11.4	-	B	40.4	-	E	12	-	B	49.1	-	E	
-	A	7.6	-	A	7.5	-	A	8.7	-	A	7.5	-	A	8.7	-	A	
-	A	5.2	-	A	5.2	-	A	5.5	-	A	5.2	-	A	5.5	-	A	
-	A	7.6	-	A	8.3	-	A	9.1	-	A	8.4	-	A	9.2	-	A	
-	A	6.5	-	A	6.8	-	A	7.7	-	A	6.8	-	A	7.7	-	A	
Drive																	
0.07	A	12.3	0.2	B	11.7	0.14	B	20.3	0.34	C	12	0.14	B	21.6	0.35	C	
0.07	A	12.3	0.2	B	11.7	0.14	B	20.3	0.34	C	12	0.14	B	21.6	0.35	C	
0.08	A	0	0.21	A	0	0.18	A	0	0.36	A	0	0.19	A	0	0.38	A	
0.06	A	2.1	0.06	A	2.1	0.08	A	2.8	0.11	A	2.1	0.08	A	2.9	0.12	A	
Vallea																	
0.33	C	16.1	0.35	B	18.5	0.33	B	16.4	0.5	B	17.5	0.32	B	15.7	0.49	B	
0.06	B	14.8	0.11	B	17.5	0.17	B	13.9	0.12	B	16.6	0.17	B	13.4	0.15	B	
0.01	A	2.5	0.02	A	3.1	0.07	A	5.1	0.09	A	2.4	0.07	A	4.2	0.09	A	
-	-	-	-	-	-	-	-	-	-	-	2.6	0.2	A	5.9	0.55	A	
0.09	A	3.1	0.31	A	3.3	0.19	A	6.9	0.54	A	-	-	-	-	-	-	
0.03	A	2.5	0.04	A	3.9	0.33	A	6	0.26	A	3.2	0.33	A	5.2	0.28	A	
-	-	-	-	-	-	-	-	-	-	-	3.4	0.47	A	5.2	0.41	A	
0.29	A	2.8	0.2	A	4.2	0.47	A	6.1	0.38	A	-	-	-	-	-	-	
0.29	A	3.9	0.31	A	4.9	0.46	A	7.5	0.53	A	4.1	0.45	A	6.5	0.54	A	
i Street																	
-	-	-	-	-	21.2	0.13	C	81.3	0.74	F	24.6	0.15	C	172.7	1.02	F	
-	-	-	-	-	16.2	0.08	C	24.8	0.17	C	17.7	0.09	C	31.9	0.22	D	
0.09	B	17.7	0.31	C	-	-	-	-	-	-	-	-	-	-	-	-	
-	-	-	-	-	21.1	0.2	C	48.8	0.38	E	25.7	0.27	D	177.6	1	F	
0.13	B	15.7	0.1	C	-	-	-	-	-	-	-	-	-	-	-	-	
-	-	-	-	-	15.8	0.17	C	26.2	0.11	D	22.2	0.33	C	33.1	0.15	D	
0.03	A	10	0.01	A	-	-	-	-	-	-	-	-	-	-	-	-	
0	A	0.2	0	A	0.2	0.01	A	0.3	0.01	A	0.2	0.01	A	0.3	0.01	A	
0	A	0	0.02	A	0	0.02	A	0	0.03	A	0	0.03	A	0	0.06	A	
0.02	A	7.9	0.02	A	7.8	0.02	A	8.9	0.04	A	7.9	0.02	A	9.2	0.04	A	
0.13	A	0	0.13	A	0	0.28	A	0	0.29	A	0	0.31	A	0	0.35	A	
0.09	A	0	0.04	A	0	0.09	A	0	0.04	A	0	0.09	A	0	0.04	A	

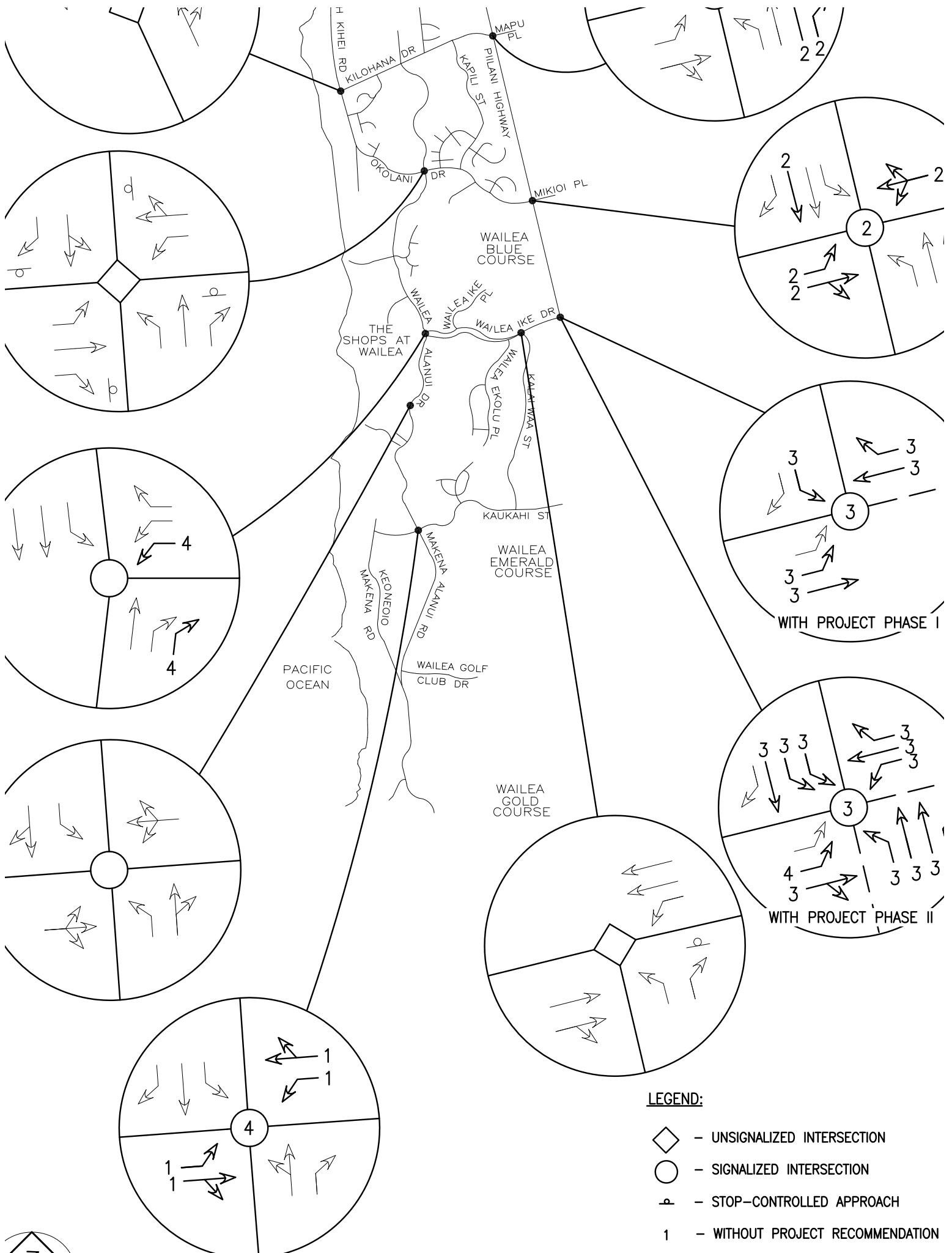
Existing 2008	Base Year 2022 without Project No Mititative Measures Recommended						Future Year 2022 with Project without Mititative Measures						Future Year 2022 with Project with Mititative Measures								
	AM			PM			AM			PM			AM			PM					
	c Ratio	LOS	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS	HCM Delay			
0.59	C	36.7	0.59	D	33.8	0.72	C	51.8	0.74	D	53	0.73	D	78	0.87	E	53.5	0.73	D	79.4	
0.11	C	30.5	0.14	C	21	0.08	C	36.2	0.14	D	37.7	0.08	D	43.2	0.16	D	37.7	0.08	D	43.2	
0.26	C	30.6	0.15	C	-	-	C	-	-	D	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	21	0.07	-	35.5	0.04	D	37.7	0.07	D	42.3	0.05	D	37.7	0.07	D	42.3	
0.1	C	30.2	0.09	C	21.1	0.1	C	36	0.11	D	37.9	0.1	D	42.9	0.13	D	37.9	0.1	D	42.9	
0.06	C	36.1	0.08	D	21.2	0.11	C	35.9	0.1	D	38	0.11	D	42.7	0.1	D	37.9	0.11	D	42.6	
-	-	36.1	0.08	D	31.1	0.14	C	49.3	0.22	D	49.3	0.05	D	54.1	0.21	D	49.4	0.05	D	54.2	
0.28	A	27.1	0.88	C	10.2	0.47	B	29.1	0.9	C	13	0.54	B	41	0.99	D	13.1	0.54	B	41.2	
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0.46	C	43.3	0.71	D	7	0	A	11.4	0.01	B	8	0	A	9.2	0.01	A	8.1	0	A	9.2	
0.69	A	11.2	0.53	B	28.9	0.41	C	51.9	0.7	D	49.3	0.38	D	79.6	0.86	E	49.4	0.38	D	79.7	
0.08	A	6.9	0.09	A	13.2	0.78	B	12.6	0.61	B	17.7	0.81	B	16.3	0.77	B	17.9	0.81	B	16.3	
0.68	B	23.6	0.8	C	6.1	0.11	A	8.4	0.16	A	7.7	0.12	A	7.9	0.16	A	7.7	0.12	A	7.9	
-	-	-	-	-	14.1	0.77	B	24.7	0.83	C	19.3	0.78	B	32.9	0.95	C	19.4	0.78	B	33.2	
0.18	C	141.7	0.95	F	22.4	0.63	C	41.1	0.81	D	38.5	0.76	D	51.2	0.84	D	38.5	0.76	D	51.2	
-	-	-	-	-	16	0.06	B	22.5	0.11	C	22.7	0.06	C	27.4	0.11	C	22.7	0.06	C	27.4	
0.26	C	27.7	0.26	D	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	17	0.24	B	22.7	0.14	C	24.2	0.28	C	27.6	0.14	C	24.2	0.28	C	27.6	
0	A	8.3	0.01	A	31.9	0.33	C	37.5	0.42	D	41.8	0.34	D	49	0.52	D	41.8	0.34	D	49	
0.13	A	0	0.43	A	10.4	0.38	B	22.3	0.83	C	11.9	0.5	B	40.4	0.99	D	11.9	0.5	B	40.4	
0.01	A	0	0.02	A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0.02	A	9.5	0.09	A	28	0.43	C	37.1	0.56	D	34.8	0.35	C	53.5	0.67	D	34.8	0.35	C	53.5	
0.43	A	0	0.28	A	21	0.9	-	16.4	0.7	B	20.4	0.9	C	24.8	0.89	C	20.4	0.9	C	24.8	
0.04	A	0	0.02	A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0	A	11.9	0	B	18.4	0.73	B	22.2	0.86	C	19.5	0.86	B	34.5	0.97	C	19.5	0.86	B	34.5	
To be constructed with Project only																					
To be constructed with Project only																					
0.04	A	0	0.14	A	0	0.14	A	0	0.3	A	0	0.16	A	0	0.33	A	0	0.16	A	0	
0.09	A	9.4	0.08	A	10	0.27	A	15.5	0.34	C	10.6	0.3	B	18	0.4	C	10.6	0.3	B	18	
0.21	A	0	0.13	A	0	0.37	A	0	0.25	A	0	0.4	A	0	0.3	A	0	0.4	A	0	
0.02	C	23.6	0.05	C	208.1	0.92	F	Err	3.44	F	354.2	1.22	F	Err	5.4	F	354.2	1.22	F	Err	
0.04	A	12	0.21	B	11.3	0.18	B	36.6	0.75	E	11.8	0.2	B	55.1	0.87	F	11.8	0.2	B	55.1	
0.04	A	0	0.14	A	0	0.14	A	0	0.3	A	0	0.16	A	0	0.33	A	0	0.16	A	0	
0.09	A	9.4	0.08	A	10	0.27	A	15.5	0.34	C	10.6	0.3	B	18	0.4	C	10.6	0.3	B	18	
0.21	A	0	0.13	A	0	0.37	A	0	0.25	A	0	0.4	A	0	0.3	A	0	0.4	A	0	
0.02	C	23.6	0.05	C	208.1	0.92	F	Err	3.44	F	354.2	1.22	F	Err	5.4	F	354.2	1.22	F	Err	
0.04	A	12	0.21	B	11.3	0.18	B	36.6	0.75	E	11.8	0.2	B	55.1	0.87	F	11.8	0.2	B	55.1	



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APPENDIX E

RECOMMENDED LANE CONFIGURATIONS





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APPENDIX F

RESORT RESIDENTIAL TRIP GENERATION RATE DEVELOPMENT

Resort Residential Trip Generation Rate Development

Background

At the request of the State of Hawaii Department of Transportation (HDOT), data were collected to determine if the resort residential trip generation rates documented in the Institute of Transportation Engineers publication entitled, Trip Generation, 7th Edition, were appropriate for the Wailea-Makena area on Maui.

Three major developers within the Wailea-Makena area agreed to participate in this effort and directed their traffic consultants to develop a methodology to collect trip data and use these data to determine alternative resort residential trip generation rates. The three traffic consultants involved were Austin-Tsutsumi and Associates, Parsons Brinckerhoff, and Phillip Rowell Associates.

This write-up summarizes the methodology used to develop alternative resort residential trip generation rates based on observation of existing resort residential development located in Wailea Resort.

Methodology

In developing a methodology to research resort residential trip generation rates for the Wailea-Makena area, it was decided to collect data separately for single-family and for multi-family resort residential development. All developments used for data collection were located in the Wailea Resort area.

Effort was made to determine which multi-family resort residential developments allow units to be rented out as opposed to units that only allow owners and selected guests to occupy the units. Effort was also made through discussions with the Wailea Homeowners Association and Wailea Resort to determine which resort residential developments were primarily absentee owner units that are occupied only a few months out of the year and resident owner units that are occupied all year long.

Based on these criteria, 24-hour traffic data were collected at the accesses to resort residential between July 7, 2006 and July 17, 2006. Using the categories of resort residential identified in the previous paragraph, data were collected at the developments summarized in Table 1.

Table 1
Resort Residential Development Data Collection Sites

Development Name	Residents/ Long-Term Rental	Short-Term Rental	Total Units
Single-Family			
Pualani Estates	92	0	92
Wailea Golf Vistas	48	0	48
Wailea Highlands	23	0	23
Wailea Golf Estates	61	0	61
Wailea Kialoa	102	0	102
Multi-Family			
Palms I	19	139	150
Palms II	120	0	120
Grand Champions	73	128	201
Wailea Elua	73	79	152
Fairway Villas	118	0	118
Note: Fairway Villas data were available because of technical difficulties and the sale of Makena Resort.			

All of the multi-family developments were used to calculate trip generation rates for resort multi-family development. This probably makes this rate conservatively high, since it contains both developments that allow short-term rentals and those that do not.

For the single-family developments, only Wailea Golf Estates and Pualani Estates were used to calculate trip generation rates. There were units in Wailea Golf Vistas and Wailea Highlands that were still under construction and it was judged that construction traffic would create an atypical trip generation rate. Wailea Kialoa was not used because it was determined through discussions with Wailea Resort and the Wailea Homeowners Association that Wailea Kialoa contained mostly residents that live in Wailea year round. This is not the typical resort residential situation in which owners usually occupy the unit only part time.

The resulting trip generation rates for resort single-family and resort multi-family are shown in Table 2.

Table 2
Resort Residential Trip Generation Rates

Parcel	AM Peak Hour		PM Peak Hour	
	Rate	Enter/Exit %	Rate	Enter/Exit %
Resort Single-Family Residential	0.46	58/42	0.46	50/50
Resort Multi-Family Residential	0.22	40/60	0.34	49/51

Note: Rates are vehicle trips per hour per dwelling unit.
 Single Family rates based on average of Wailea Golf Estates and Pualani Estates.
 Multi-Family rates based on average of Wailea Grand Champions, Palms I, Palms II, and Wailea Elua

Table 3 compares the calculated resort residential rates with the ITE published rates. As shown, the calculated resort residential rates for the single-family resort residential are about twice as high as the ITE published rates, and the calculated resort residential rates for the multi-family resort residential are slightly higher for than those published by ITE.

Table 3
Comparison of Calculate and ITE Published Resort Residential Trip Generation Rates

Rate Source	AM Peak Hour		PM Peak Hour	
	Rate	Enter/Exit %	Rate	Enter/Exit %
Calculated Single-Family Residential	0.46	58/42	0.46	50/50
Calculated Multi-Family Residential	0.22	40/60	0.34	49/51
ITE Published Recreational Homes (260)	0.16	67/33	0.26	41/59

Note: Rates are vehicle trips per hour per dwelling unit.