TRAFFIC IMPACT ANALYSIS REPORT FOR

KAHULUI TOWN CENTER AND MIXED USE PROJECT

IN KAHULUI, MAUI, HAWAII

Prepared For

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1. INTRODUCTION

Phillip Rowell and Associates has been retained to prepare a traffic impact analysis for the proposed Kahului Town Center and Mixed Use Project in the Kahului area of Maui. The approximate location of the project on the Island of Maui is shown in Figure 1.

This introductory chapter discusses the location of the project, proposed development plan, the study methodology and order of presentation.

Purpose and Objectives of Study

1. Determine and describe the traffic characteristics of the proposed project.

2. Quantify and document the traffic related impacts of the proposed project.

3. If required, identify and evaluate traffic related improvements required to provide adequate access to and egress from the proposed project and to mitigate the project's traffic impacts.

Figure 1 Project Location on Maui

Project Location and Description

The location of the project within Kahului is shown schematically in Figure 2. This diagram indicates the streets bordering the project.

The project site is divided into four quadrants as shown. The proposed uses within each quadrant are summarized in Table 1.

Table 1 Summary of Proposed Development Plan

Proposed Use	Units	Quad 1	Quad 2	Quad 3	Quad 4	Total
Residential	Units	0	80	295	67	442
Existing Office Building	Gross Square Feet	0	0	0	56,653	56,653
New Office Building	Gross Square Feet	61,574	0	0	34,596	96,170
Bank	Gross Square Feet	9,000	0	0	4,180	13,180
Restaurant	Gross Square Feet	4,484	1,258	6,593	0	12,335
Retail	Gross Square Feet	36,234	12,163	40,732	29,414	118,543

Also shown on Figure 2 are Town Center Drive and Kinau Avenue, which divide the project into quadrants. Kinau Avenue is an extension of the existing entrance to Kahului Shopping Center through to Kamehameha Avenue. The proposed driveways serving the project's parking facilities are shown and designated Drives A through I.

Horizon Year

The design horizon year represents a date for which future background traffic projections were estimated. These projections include traffic generated by other planned projects within and adjacent to the study area and background traffic growth, for which a future year must be selected.

The year 2012 was used as the horizon year, even though the project will be developed in phases, with the fourth and final phase tentatively scheduled for completion in 2012. Rather than perform a traffic analysis for each phase, it was decided to use 2012 as the design year and analyze the total project.

Figure 2 Location Map of Project within Kahului

Study Methodology

The following is a summary list of the tasks performed:

1. The study area and the scope of work was defined using criteria established by the Institute of Transportation Engineers[1] for large developments. See Table 2.

2. A field reconnaissance was performed to identify existing roadway cross-sections, intersection lane configurations, traffic control devices, and surrounding land uses.

3. Existing traffic volumes were obtained from recently completed traffic studies in the area. As will be explained in Chapter 2, traffic counts from the MCC Student Housing and Kane Street Mixed Use Projects were used to be consistent with the findings of that study. With the exception of one intersection, all counts are less than two years old.

4. Existing levels-of-service of the study intersections were determined using the methodology described in the *2000 Highway Capacity Manual*.

5. A list of related development projects within and adjacent to the study area that will impact traffic conditions at the study intersections was compiled. This list included both development projects and anticipated highway improvement projects.

6. Future background traffic volumes at the study intersections without traffic generated by the study project were estimated.

7. Peak hour traffic that the proposed project will generate was estimated using trip generation analysis procedures recommended by the Institute of Transportation Engineers.

8. Project generated traffic was assigned to the adjacent roadway network for each of the four scenarios described previously.

9. A level-of-service analysis for future traffic conditions with traffic generated by the study project was performed.

10. The impacts of traffic generated by the proposed project at the study intersections was quantified and summarized.

11. Locations that project generated traffic significantly impacts traffic operating conditions were identified.

12. If required, improvements or modifications necessary to mitigate the traffic impacts of the project and to provide adequate access to and egress from the site were formulated.

13. A report documenting the conclusions of the analyses performed and recommendations was prepared.

[1] Institute of Transportation Engineers, *Transportation and Land Development, Second Edition*, Washington, D.C., 2002, pages 3-1 thru 3-16.

Table 2 Suggested Requirements for Various Types of Traffic Impact Analyses[2]

	Trip Generation Threshold			
	Access Location & Design Review	Small Development: Traffic Impact Assessment	Medium Development: Traffic Impact Statement	Large Development: Regional Traffic Analysis
	T ≤ 100 Peak Hour Trips	100 < T ≤ 500 Peak Hour Trips	500 < T ≤ 1000 Peak Hour Trips	T > 1000 Peak Hour Trips
Pre-application meeting or discussion	✔	✔	✔	✔
Analysis of Roadway Issues				
Existing condition analysis within study area	✔	✔	✔	✔
Sight distance evaluation	✔	✔	✔	✔
Nearby driveway locations	**?**	✔	✔	✔
Existing traffic conditions at nearby intersections and driveways		✔	✔	✔
Future road improvements		**?**	✔	✔
Crash experience in proximity to site	**?**	✔	✔	✔
Trip generation of adjacent development		**?**	✔	✔
Trip distribution analysis		✔	✔	✔
Background traffic growth		**?**	✔	✔
Future conditions analysis at nearby intersections		**?**	✔	✔
Mitigation identification and evaluation		**?**	**?**	✔
Site Issues				
Traffic generation	✔	✔	✔	✔
Traffic distribution	**?**	✔	✔	✔
Evaluate number, location & spacing of access points	**?**	✔	✔	✔
Evaluate access design, queuing, etc.	✔	✔	✔	✔
Evaluate site circulation	✔	✔	✔	✔
Other Analyses				
Gap analysis for unsignalized locations		**?**	**?**	✔
TSM/TDM Mitigation measures (car- or van-pooling, transit, etc.)- transit agency participation			**?**	✔
Effect on traffic signal progression, analysis of proposed signal locations	(4)	(4)	**?**	✔

Notes:
(1) Key: ✔ = required, **?** = may be appropriate on a case-by-case basis
(2) Source: Institute of Transportation Engineers, *Transportation and Land Development*, Washington, D.C., 2002, p.3-6
(3) TSM/TDM = Transportation System Management/Transportation Demand Management
(4) A traffic signal should not be permitted

Study Area

The study area for this study is consistent with the study area for the traffic impact study prepared for the MCC Student Housing and Kane Street Mixed Use Projects and recent direction from the County of Maui Department of Public Works. The study intersections are listed in Table 3. There are 18 existing intersections, one (1) proposed as part of the MCC Student Housing Project and (9) intersections and driveways proposed as part of the Kahului Town Center project.

Table 3 Study Intersections

Number	Intersection	Status
1	Wakea Avenue at Kaahumanu Avenue	Existing
2	Kahului Beach Road at Kaahumanu Avenue	Existing
3	School Street at Kaahumanu Avenue (1)	See Note Below
4	Lono Avenue at Kaahumanu Avenue	Existing
5	Kahului Shopping Center (Center Street) at Kaahumanu Avenue	Existing
6	Puunene Avenue at Kaahumanu Avenue	Existing
7	Maui Mall at Kaahumanu Avenue	Existing
8	Hana Highway at Kamehameha Avenue	Existing
9	Puunene Avenue at Kahului Shopping Center North	Existing
10	Puunene Avenue at Kahului Shopping Center South	Existing
11	Puunene Avenue at Kamehameha Avenue	Existing
12	Puunene Avenue at Wakea Avenue	Existing
13	Lono Avenue at Vevau Street	Existing
14	Lono Avenue at Kamehameha Avenue	Existing
15	Lono Avenue at Wakea Avenue	Existing
17	School Street at Kamehameha Avenue	Existing
18	Lono Street at Vevau Street	Existing
31	Kane Street at Kamehameha Avenue	Existing
32	Kane Street at Vevau Street	Existing
51	Town Center Drive at Kinau Avenue	Proposed as part of project
52	Town Center Drive at Drive C	Proposed as part of project
53	Town Center Drive at Drives G & H	Proposed as part of project
54	Kinau Avenue at Drives B & D	Proposed as part of project
55	Kinau Avenue at Drive L	Proposed as part of project
56	Kinau Avenue at Drive K	Proposed as part of project
57	Kinau Avenue at Kamehameha Avenue	Proposed as part of project
58	Kamehameha Avenue at Drive J	Proposed as part of project
59	Puunene Avenue at Drive I	Proposed as part of project

Notes:
(1) School Street at Kaahumanu Avenue was removed from the analysis because SDOT stated that they would not allow a connection to Kaahumanu Avenue.

Order of Presentation

Chapter 2 describes existing traffic conditions, the Level-of-Service (LOS) concept and the results of the Level-of-Service analysis of existing conditions.

Chapter 3 describes the process used to estimate 2012 background traffic volumes and the resulting background traffic projections. Background conditions are defined as future background traffic conditions without traffic generation by the study project.

Chapter 4 describes the methodology used to estimate the traffic characteristics of the proposed project, including 2012 background plus project traffic projections.

Chapter 5 describes the traffic impacts of the proposed project.

Chapter 6 describes the conclusions of the impact analysis and recommended mitigation measures.

2. ANALYSIS OF EXISTING CONDITIONS

This chapter presents the existing traffic conditions on the roadways adjacent to the proposed project. The level-of-service (LOS) concept and the results of the Level-of-Service analysis for existing conditions are also presented. The purpose of this analysis is to establish the base conditions for the determination of the impacts of the project which are described in a subsequent chapter.

Description of Existing Streets and Intersection Controls

The following is a summary of the major roadways in the study area:

Puunene Avenue

Puunene Avenue is a major State highway connecting Kahului with Mokulele Highway, with a north-south orientation. Within the study area, Puunene Avenue is a four-lane, two-way facility with separate left turn lanes. The intersections with Kaahumanu Avenue, Kamehameha Avenue and Wakea Avenue are signalized.

Kaahumanu Avenue

Kaahumanu Avenue is a six-lane, two-way east-west State roadway connecting Wailuku and Hobron Triangle. All intersections within the study area have separate left turn storage lanes. Major intersections are signalized.

Kamehameha Avenue

East of School Street, Kamehameha Avenue is a four-lane, divided roadway connecting Hobron Triangle and Kahului. There are separate left turn lanes at the intersection with Puunene Avenue. West of School Street, Kamehameha Avenue is a two-lane roadway.

Lono Avenue

Lono Avenue is located along the eastern boundary of the project. Within the study area, Lono Avenue is a two-lane, two-way roadway with a north-south orientation. Lono Avenue is a County roadway.

Kane Street

Kane Street ends at Kaahumanu Avenue and becomes Kahului Beach Road north of Kaahumanu Avenue. Between Kaahumanu Avenue and Vevau Street, Kane Street is four lanes wide. South on Vevau Street, Kane Street is two lanes wide. Kane Street is a County Roadway.

Wakea Avenue

Within the study area, Wakea Avenue is a two-lane, two-way roadway. Within the western half of the study area, Wakea Avenue has an east-west orientation. In the vicinity of Lono Avenue, the street turns north and intersects Kaahumanu Avenue with a north-south orientation. Wakea Avenue is a County roadway.

Existing Peak Hour Traffic Volumes

The existing morning and afternoon peak hour traffic volumes are shown in Figures 3 and 4.

1. The traffic counts include buses, trucks and other large vehicles. Mopeds and Bicycles were not counted.

2. All intersections were counted from 6:30 AM to 9:00 AM and from 3:30 PM to 6:00 PM on weekdays. Traffic counts were not performed during Wednesday afternoons.

3. The traffic volumes shown are the peak hourly volume of each movement rather than the peak sum of all approach volumes.

4. The traffic volumes of adjacent intersections may not match the volumes shown for an adjacent intersection because the peak hours of the adjacent intersections may not coincide and there are driveways between the intersections.

5. Pedestrian activity was negligible.

The existing traffic volumes shown are based on the traffic counts completed for the MCC Student Housing and Kane Street Mixed Use Projects as discussed with DPW&EM during pre-consultation discussions. This was to insure that the projections, analyses and conclusions are consistent with other traffic studies for projects in the area.

During review of the TIAR for the MCC Student Housing and Kane Street Mixed Use Project, DPW&EM questioned whether traffic counts conducted on Mondays and Fridays were representative of weekday traffic counts. In response, two continuous traffic counts were performed along Kane Street for a one week period. One week with school in session and one week with school out of session. The results determined that when schools are in session, there is little difference in the morning counts. There is little variation in the afternoon peak hour volumes except for Fridays, which are 5% higher than Monday and Thursday and 6.6% higher than Tuesday and Wednesday. The conclusion of this analysis is that when schools are in session, Fridays represent typical weekday traffic volumes. Schools were in session during the traffic counts. The analysis performed for the MCC and Kane Street project is reproduced as Appendix J.

Regarding State highways, SDOT recently provided comments on a traffic count project performed as part of the Kaneohe Circulation Study in Oahu. SDOT commented that typically Friday counts are higher than the other weekday counts. A copy of this comment letter is provided in Appendix J.

Figure 3 Existing (2004) AM Peak Hour Traffic Volumes

Figure 3A Existing (2004) Peak Hour Traffic Volumes Inset

Figure 4 Existing (2004) PM Peak Hour Traffic Volumes

Figure 4A Existing (2004) PM Peak Hour Traffic Volumes Inset

Level-of-Service Concept

Signalized Intersections

"Level-of-Service" is a term which denotes any of an infinite number of combinations of traffic operating conditions that may occur on a given lane or roadway when it is subjected to various traffic volumes. Level-of-service (Level-of-Service) is a qualitative measure of the effect of a number of factors which include space, speed, travel time, traffic interruptions, freedom to maneuver, safety, driving comfort and convenience.

There are six levels-of-service, A through F, which relate to the driving conditions from best to worst, respectively. The characteristics of traffic operations for each level-of-service are summarized in Table 4. In general, Level-of-Service A represents free-flow conditions with no congestion. Level-of-Service F, on the other hand, represents severe congestion with stop-and-go conditions. Level-of-service D is typically considered acceptable for peak hour conditions in urban areas.

Corresponding to each level-of-service shown in the table is a volume/capacity ratio. This is the ratio of either existing or projected traffic volumes to the capacity of the intersection. Capacity is defined as the maximum number of vehicles that can be accommodated by the roadway during a specified period of time. The capacity of a particular roadway is dependent upon its physical characteristics such as the number of lanes, the operational characteristics of the roadway (one-way, two-way, turn prohibitions, bus stops, etc.), the type of traffic using the roadway (trucks, buses, etc.) and turning movements.

Table 4 Level-of-Service Definitions for Signalized Intersections[1]

Level of Service	Interpretation	Volume-to-Capacity Ratio[2]	Stopped Delay (Seconds)
A, B	Uncongested operations; all vehicles clear in a single cycle.	0.000-0.700	<20.0
C	Light congestion; occasional backups on critical approaches	0.701-0.800	20.1-35.0
D	Congestion on critical approaches but intersection functional. Vehicles must wait through more than one cycle during short periods. No long standing lines formed.	0.801-0.900	35.1-55.0
E	Severe congestion with some standing lines on critical approaches. Blockage of intersection may occur if signal does not provide protected turning movements.	0.901-1.000	55.1-80.0
F	Total breakdown with stop-and-go operation	>1.001	>80.0

Notes:
(1) Source: *Highway Capacity Manual*, 2000.
(2) This is the ratio of the calculated critical volume to Level-of-Service E Capacity.

Unsignalized Intersections

Like signalized intersections, the operating conditions of intersections controlled by stop signs can be classified by a level-of-service from A to F. However, the method for determining level-of-service for unsignalized intersections is based on the use of gaps in traffic on the major street by vehicles crossing or turning through that stream. Specifically, the capacity of the controlled legs of an intersection is based on two factors: 1) the distribution of gaps in the major street traffic stream, and 2) driver judgement in selecting gaps through which to execute a desired maneuver. The criteria for level-of-service at an unsignalized intersection is therefore based on delay of each turning movement. Table 5 summarizes the definitions for level-of-service and the corresponding delay.

Table 5 Level-of-Service Definitions for Unsignalized Intersections[1]

Level-of-Service	Expected Delay to Minor Street Traffic	Delay (Seconds)
A	Little or no delay	<10.0
B	Short traffic delays	10.1 to 15.0
C	Average traffic delays	15.1 to 25.0
D	Long traffic delays	25.1 to 35.0
E	Very long traffic delays	35.1 to 50.0
F	See note (2) below	>50.1

Notes:
(1) Source: *Highway Capacity Manual*, 2000.
(2) When demand volume exceeds the capacity of the lane, extreme delays will be encountered with queuing which may cause severe congestion affecting other traffic movements in the intersection. This condition usually warrants improvement of the intersection.

Level-of-Service Analysis of Existing Conditions

The existing levels-of-service of the study intersections are summarized in Table 6. State of Hawaii Department of Transportation requested that the level-of-service analysis be performed using the Synchro software. The level-of-service analysis of the signalized intersections was therefore performed using Synchro 6. The timing from Synchro was then download into the *Highway Capacity Software* to perform the level-of-service analysis. The results shown in the table are the volume-to-capacity ratios, delays and levels-of-service of the overall intersections as reported by the *Highway Capacity Software*.

For unsignalized intersections, the delays and levels-of-service of the lowest controlled lane groups are shown in the table. All the remaining controlled movements of the intersection operate at a higher level-of-service than that shown in the table. The *Highway Capacity Software* nor Synchro calculates the volume-to-capacity ratio of an unsignalized intersection.

Table 6 Existing (2004/2005) Levels-of-Service

		AM Peak Hour			PM Peak Hour		
Peak Hour and Movement	Right-of-Way Control	V/C(1)	Delay(2)	LOS(3)	V/C	Delay	LOS
Kaahumanu Av. at Wakea Av.	Signalized	0.52	22.9	C	0.68	25.4	C
Kaahumanu Av. at Kahului Beach Rd.	Signalized	0.71	219.7	F	0.85	54.7	D
Kaahumanu Av. at Lono Av.	Signalized	0.60	22.2	C	0.74	19.5	B
Kaahumanu Av. at Kahului SC	Unsignalized		>999.9	F		>999.9	F
Kaahumanu Av. at Puunene Av.	Signalized	0.63	26.0	C	1.00	51.5	D
Kaahumanu Av. at Maui Mall	Signalized	0.37	15.2	B	0.61	18.2	B
Hana Highway at Kamehameha Av.	Signalized	0.58	31.8	C	0.88	52.7	D
Puunene Av at Kahului Shopping Center North	Unsignalized		19.8	C		49.6	E
Puunene Av at Kahului Shopping Center South	Unsignalized		32.3	D		257.3	F
Kamehameha Av. at Puunene Av.	Signalized	0.52	18.7	C	0.88	30.0	C
Puunene Av. at Wakea Av.	Signalized	0.69	45.9	D	0.73	38.7	D
Lono Av. at Vevau St.	Unsignalized		14.0	B		33.3	D
Kamehameha Av. at Lono Av.	Signalized	0.33	9.0	A	0.43	10.6	B
Lono Av. at Wakea Av.	Signalized	0.46	16.3	B	0.47	15.0	B
Kamehameha Av. at School St.	Unsignalized		13.0	B		18.0	C
Kamehameha Av. at Kane St.	Unsignalized		30.5	D		151.2	F
Kane St. at Vevau St.	Unsignalized		20.8	C		47.4	E

NOTES:
1. V/C denotes ratio of volume to capacity. V/C ratios are not calculated for unsignalized intersections.
2. Delay is in seconds per vehicle.
3. LOS denotes Level-of-Service calculated using the operations method described in *Highway Capacity Manual*. LOS is based on delay.

Detailed results of the level-of-service calculations indicating the delays and level-of-service of each movement are presented as Appendices A and B.

3. PROJECTED BACKGROUND TRAFFIC CONDITIONS

The purpose of this chapter is to discuss the assumptions and data used to estimate background traffic conditions. Background traffic conditions are defined as future traffic volumes without the proposed project.

Future traffic growth consists of two components. The first is ambient background growth that is a result of regional growth and cannot be attributed to a specific project. This growth factor also considers traffic associated with minor, or small, projects for which no traffic data are available.

The second component is estimated traffic that will be generated by other development projects in the vicinity of the proposed project.

Design Year for Traffic Forecasts

The design, or horizon, year of a project is the future year for which background traffic conditions are estimated. As noted in Chapter 1, the anticipated completion date of the final phase of the project is 2012.

Background Traffic Growth

The *Maui Long Range Transportation Plan*[2] concluded that traffic in Maui would increase an average of 1.6% per year from 1990 to 2020. This growth rate was used to estimate the background growth between 2005 and 2012. The growth factor was calculated to be 1.1354 using the following formula:

$$F = (1 + i)^n$$

where F = Growth Factor
i = Average annual growth rate, or 0.016
n = Growth period in years

The growth factors were applied to all traffic movements at the study intersections.

Related Projects

The second component in estimating background traffic volumes is traffic resulting from other proposed projects in the vicinity. Related projects are defined as those projects that are likely to be constructed and would significantly impact traffic in the study area. Related projects may be development projects or roadway improvements.

Six projects were identified as related projects. The approximate locations of these projects are shown in Figure 5 and the number of estimated peak hour trips generated by each is summarized in Table 7.

Table 7 Related Projects

		AM Peak Hour Trips			PM Peak Hour Trips		
Letter(1)	Project Name/Description	In	Out	Total	In	Out	Total
A	Mercedes of Maui	55	44	99	41	44	85
B	Maui Oil Company Carwash	29	26	55	26	29	55
C	Maui Beach Hotel Renovation	39	32	71	48	35	83
D	Lono St and Kane St Projects	59	98	157	166	145	311
E	Maui Business Park Phase II	1172	471	1643	2099	2565	4664
F	Not Used						
G	Maui Lani	1224	1409	2633	1862	1786	3648
H	Maui Land & Pine Office Project	59	98	157	105	84	189

Notes:
(1) See Figure 5 for locations of projects.

Not shown on the list of related projects is the proposed Superferry. SDOT-Harbors and the EIS consultant were contacted regarding the traffic characteristics of the Superferry. We were advised that no peak hour traffic will be generated by the Superferry. Therefore, the Superferry will not impact peak hour traffic conditions in the study area. In response to comments from SDOT and County of Maui, an analysis of Superferry generated traffic superimposed on the afternoon peak hour traffic was performed. This analysis and the results are presented as Appendix F.

Also not shown is expanded services of at Kahului Harbor. Based on a review of the Kahului Harbor Master Plan report, the growth of traffic associated with the harbor is included in the background growth rate previously described as growth will be consistent with historical trends.

[2] Kaku Associates, October 1996

Traffic assignments for the related projects were obtained from their respective traffic studies if available. For projects that did not have a traffic impact study, the project descriptions were used to estimate the peak hour trips that the projects will generate. The trips were then distributed and assigned to the study intersections.

Background Traffic Projections

Background traffic projections were calculated by expanding existing traffic volumes by the appropriate growth rates (1.1354) and then superimposing traffic generated by related projects. The resulting peak hour traffic projections are shown on Figures 6 and 7.

Figure 5 Locations of Related Projects

Figure 6 2012 Background AM Peak Hour Traffic Projections

Figure 6A 2012 Background AM Peak Hour Traffic Projections Inset

Figure 7 2012 Background PM Peak Hour Traffic Projections

Figure 7A 2012 Background PM Peak Hour Traffic Projections Inset

4. PROJECT-RELATED TRAFFIC CONDITIONS

This chapter discusses the methodology used to estimate the amount of project generated traffic at the study intersections. Generally, the process involves the estimation of weekday peak-hour trips that would be generated by the proposed project, distribution and assignment of these trips on the approach and departure routes, and finally, determination of future background plus project traffic projections.

The results of the level-of-service analysis of background plus project conditions are presented in the following chapter.

Trip Generation Analysis Methodology and Assumptions

Traffic volumes generated by the project were estimated using the procedures described in the *Trip Generation Handbook,*[3] published by the Institute of Transportation Engineers. This method uses trip generation rates and equations to estimate the number of trips that a project will generate during the morning and afternoon peak hours. Trip generation analysis was performed using trip generation data provided by the Institute of Transportation Engineers.[4] Separate trip generation analyses were performed for each quadrant of the project.

[3] Institute of Transportation Engineers, *Trip Generation Handbook*, Washington, D.C., 1998, p. 7-12

[4] Institute of Transportation Engineers, *Trip Generation, Seventh Edition*, Washington, D.C., 2003

The proposed development within each quadrant is summarized in Table 8.

Table 8 Proposed Development Plan By Quadrant

Proposed Use	Land Use Code	Units	Quadrant 1	Quadrant 2	Quadrant 3	Quadrant 4	Totals
Residential	230	Units	0	80	295	67	442
Existing Office	710	Square Feet	0	0	0	56,653	56,653
New Office	710	Square Feet	61,574	0	0	34,596	96,170
Bank	912	Square Feet	9,000	0	0	4,180	13,180
Restaurant	832	Square Feet	4,484	1,258	6,593	0	12,335
Retail	820	Square Feet	36,234	12,163	40,732	29,414	118,543

Notes:
(1) Source:

The assumptions used for the trip generation analysis are:

1. Trip generation rates for condominiums were used to estimated the number of peak hour trips generated by the condominium. These trip rates are based on the number of units.

2. The trip generation rates for general office buildings were used to estimate the peak hour trips generated by the existing and proposed office buildings. These rates are based on the gross square feet of floor area.

3. The trip generation rates for walk-in banks were used to estimate the peak hour trips generated by the banks. These rates are based on the gross square feet of floor area.

4. The trip generation rates for sit-down restaurants were used to estimate the peak hour trips generated by the restaurants. These rates are based on the gross square feet of floor area.

5. Trip generation rates for shopping centers were used to estimate the number of peak our trips generated by the retail portion of the project. These rates are based on the leasable floor area. It was assumed that the leasable floor area is 85% of the gross floor area.

The trip generation rates and equations are summarized in Table 9.

Table 9 Trip Generation Rates Used for the Trip Generation Analysis

Propose Use		Residential Condominiums	Office (New and Existing)	Bank	Restaurant	Retail
Land Use Code		230	710	912	832	820
Period & Direction		Trips per Unit or %				
AM Peak Hour	Total	0.44	1.55	12.34	9.27	Ln (T) = 0.60Ln(A)+2.29
	Inbound	18%	88%	56%	52%	61%
	Outbound	82%	12%	44%	48%	39%
PM Peak Hour	Total	0.52	1.49	45.74	10.86	Ln (T) = 0.66Ln(A)+3.40
	Inbound	64%	17%	50%	60%	48%
	Outbound	36%	83%	50%	40%	52%

Note: T = Trips, A = 1,000 gross leasable square feet

Discount for Mixed Used Development

The total number of trips was discounted to account for reduced trips generated by the mixed use development. This discount was estimated separately for each type of use within the project. The discount for the retail trips was estimated by comparing the sum of the trips generated by each quadrant to the trips generated by the total retail within the project. Since the number of trips generated by retail projects is non-linear, the difference between the two calculations is the discount applicable for the overall development. The estimated discount was applied to both new retail trips and pass-by retail trips.

The discount for the remaining elements of the project was estimated by comparing the estimated number of trips generated by each component of the project and allocating 5% of the trips as internal-internal trips. This is a small percentage as compared to the discount allowed by other jurisdictions for multi-use developments, which typically range between 10% and 15%. Therefore, the discounts that were used for this project are conservative.

The discounts used are summarized in Table 10.

Table 10 Discounts for Mixed Use Development

Proposed Use	Land Use Code	Mixed Use Discount AM	PM
Residential	230	5%	5%
Existing Office	710	5%	5%
New Office	710	5%	5%
Bank	912	5%	5%
Restaurant	832	5%	5%
Retail	820	40%	35%

Trips Generation Analysis Results

The total trips generated by the project are summarized in Table 11. Detailed trip generation calculations for each quadrant and the total project are provided as Appendix C.

Table 11 Total Trips Generated by Proposed Project

Total Trips Generated By Project - Unadjusted for Mixed Use Development

Period & Direction		Residential	Existing Office	New Office	Bank	Restaurant	Retail			Project Totals		
							Total	Pass By	Net	Total	Pass By	Net
AM Peak Hour	Total	194	88	149	163	115	268		268	977	0	977
	In	33	77	132	91	60	163		163	556	0	556
	Out	161	11	17	72	55	105	0	105	421	0	421
PM Peak Hour	Total	230	84	144	603	135	990	574	416	2186	574	1612
	In	153	14	25	302	80	474	288	186	1048	288	760
	Out	77	70	119	301	55	516	286	230	1138	286	852

Discounts for Mixed Use Development

Period & Direction		Residential	Existing Office	New Office	Bank	Restaurant	Retail			Project Totals		
							Total	Pass By	Net	Total	Pass By	Net
AM Peak Hour	Total	10	4	8	9	6	107		107	144	0	144
	In	1	4	6	4	3	65		65	83	0	83
	Out	9	0	2	5	3	42	0	42	61	0	61
PM Peak Hour	Total	12	4	8	31	7	347	201	146	409	201	208
	In	7	1	1	15	3	165	102	63	192	102	90
	Out	5	3	7	16	4	182	99	83	217	99	118

Total Trips Generated By Project - Adjusted for Mixed Use Development

Period & Direction		Residential	Existing Office	New Office	Bank	Restaurant	Retail			Project Totals		
							Total	Pass By	Net	Total	Pass By	Net
AM Peak Hour	Total	184	84	141	154	109	161	0	161	833	0	833
	In	32	73	126	87	57	98	0	98	473	0	473
	Out	152	11	15	67	52	63	0	63	360	0	360
PM Peak Hour	Total	218	80	136	572	128	643	373	270	1777	373	1404
	In	146	13	24	287	77	309	188	121	856	188	668
	Out	72	67	112	285	51	334	185	149	921	185	736

Trip Distribution and Assignments

The project-related trips were distributed along the anticipated approach routes to and departure routes from the project site based on the directional distribution of existing peak hour traffic and adjacent land uses. The project trip assignments are shown on Figures 8 and 9. The pass by trip assignments are shown on Figure 10.

2012 Background Plus Project Projections

Background plus project traffic conditions are defined as 2012 background traffic conditions plus project related traffic. These projections were estimated by subtracting traffic generated by existing development and then superimposing the peak hourly traffic generated by the proposed project onto the net 2012 background peak hour traffic volumes. Traffic generated by the existing on-site development was subtracted from the background traffic stream manually. This calculation is shown in the traffic projection worksheets that are presented as Appendix D.

The resulting peak hour traffic projections for 2012 background plus project conditions are shown on Figures 11 and 12.

Figure 8 AM Project Trip Assignments

Figure 8A AM Project Trip Assignments Inset

Figure 9 PM Project Trip Assignments

Figure 9A PM Project Trip Assignments Inset

Figure 10 Pass By Trip Assignments

Figure 11 Background (2012) Plus Project AM Peak Hour Traffic Projections

Figure 11A Background (2012) Plus Project AM Peak Hour Traffic Projections Inset

Figure 12 Background (2012) Plus Project PM Peak Hour Traffic Projections

Figure 12A Background (2012) Plus Project PM Peak Hour Traffic Projections Inset

5. TRAFFIC IMPACT ANALYSIS

The purpose of this chapter is to summarize the results of the level-of-service analysis, which identifies the project-related impacts. In addition, any mitigation measures necessary and feasible are identified and other access, egress and circulation issues are discussed.

The impact of the project was assessed by analyzing the changes in traffic volumes and levels-of-service at the study intersections. Mitigation measures are described in the following chapter.

Changes in Total Intersection Volumes

An analysis of the project's share of 2012 background plus project intersection approach volumes at the study intersections is summarized in Table 12. The table summarizes the project's share of total 2012 peak hour approach volumes at each intersection. Also shown are the percentage of 2012 background plus project traffic that is the result of background growth and traffic generated by related projects.

An analysis of the project's pro rata share of the increase of traffic volumes between 2005 and 2012 summarized in Table 13. This table summarizes the growth between 2005 and 2012 and indicates the percentage of growth resulting from background growth and related projects and the percentage growth resulting from project generated traffic.

Table 12 Analysis of Project's Share of Total Intersection Approach Volumes [1]

Intersection	Period	Existing	2012 Background	2012 Background Plus Project	Background Growth		Project Traffic	
					Trips	Percent of Total Traffic [2]	Trips	Percent of Total Traffic [3]
Wakea Av at Kaahumanu Av	AM	2850	3360	3525	510	14.5%	165	4.7%
	PM	3130	3690	3987	560	14.0%	297	7.4%
Kahului Beach Rd at Kaahumanu Av	AM	3865	4780	5054	915	18.1%	274	5.4%
	PM	4780	6125	6637	1345	20.3%	512	7.7%
Lono St at Kaahumanu Av	AM	3670	4430	4668	760	16.3%	238	5.1%
	PM	4300	5195	5637	895	15.9%	442	7.8%
Center St at Kaahumanu Av	AM	3445	4110	4046	665	16.4%	-64	-1.6%
	PM	4245	5070	5073	825	16.3%	3	0.1%
Puunene Av at Kaahumanu Av	AM	3520	4195	4170	675	16.2%	-25	-0.6%
	PM	4475	5335	5315	860	16.2%	-20	-0.4%
Maui Mall at Kaahumanu Av	AM	2445	2980	3005	535	17.8%	25	0.8%
	PM	2935	3575	3612	640	17.7%	37	1.0%
Hana Hwy at Kaahumanu Av	AM	3055	3835	3902	780	20.0%	67	1.7%
	PM	3990	5105	5209	1115	21.4%	104	2.0%
Puunene Av at Maui Mall North	AM	1240	1415	1395	175	12.5%	-20	-1.4%
	PM	1740	2015	1940	275	14.2%	-75	-3.9%
Puunene Av at Maui Mall South	AM	1345	1535	1512	190	12.6%	-23	-1.5%
	PM	1745	2035	1957	290	14.8%	-78	-4.0%
Puunene Av at Kamehameha Av	AM	2390	2880	3023	490	16.2%	143	4.7%
	PM	3285	4115	4367	830	19.0%	252	5.8%
Puunene Av at Wakea Av	AM	2420	2805	3023	385	12.7%	218	7.2%
	PM	2785	3355	3731	570	15.3%	376	10.1%
Lono Av at Vevau St	AM	710	815	1055	105	-1.0% (3)	240	22.7%
	PM	990	1185	1702	195	-3.5% (3)	517	30.4%
Lono St at Kamehameha Av	AM	1145	1315	1427	170	11.9%	112	7.8%
	PM	1615	2055	2199	440	20.0%	144	6.5%
Lono Av at Wakea Av	AM	1905	2190	2273	285	12.5%	83	3.7%
	PM	1965	2285	2368	320	13.5%	83	3.5%
School St at Kamehameha Av	AM	610	800	800	190	23.8%	0	0.0%
	PM	885	1180	1180	295	25.0%	0	0.0%
Kane St at Kamehameha Av	AM	785	990	990	205	20.7%	0	0.0%
	PM	1430	1995	1995	565	28.3%	0	0.0%
Kane St at Vevau St	AM	675	775	868	100	11.5%	93	10.7%
	PM	1030	1165	1534	135	8.8%	369	24.1%

Notes:
(1) Volumes shown are total intersection approach volumes or projections.
(2) Percentage of total 2012 background plus project traffic.
(3) Background traffic projections are less than existing traffic volumes because traffic is redistributed as a result of converting Vevau Street from two-way to one-way between Kane Street and Vevau Street. This redistribution of traffic results in negative percentages for background growth . This anomaly distorts the calculations to overestimate percentages of project generated traffic.

Table 13 Analysis of Project's Share of Total Intersection Approach Volumes Growth (1)

Intersection	Period	Existing	2012 Background	Background Plus Project	Background Growth (2) Volume	Background Growth (2) % of 2005 to 2012 Growth	Project Trips (3) Volume (4)	Project Trips (3) % of 2005 to 2012 Growth
Wakea Av at Kaahumanu Av	AM	2850	3360	3525	510	75.6%	165	24.4%
	PM	3130	3690	3987	560	65.3%	297	34.7%
Kahului Beach Rd at Kaahumanu Av	AM	3865	4780	5054	915	77.0%	274	23.0%
	PM	4780	6125	6637	1345	72.4%	512	27.6%
Lono St at Kaahumanu Av	AM	3670	4430	4668	760	76.2%	238	23.8%
	PM	4300	5195	5637	895	66.9%	442	33.1%
Center St at Kaahumanu Av	AM	3445	4110	4046	665	110.6%	-64	-10.6%
	PM	4245	5070	5073	825	99.6%	3	0.4%
Puunene Av at Kaahumanu Av	AM	3520	4195	4170	675	103.8%	-25	-3.8%
	PM	4475	5335	5315	860	102.4%	-20	-2.4%
Maui Mall at Kaahumanu Av	AM	2445	2980	3005	535	95.5%	25	4.5%
	PM	2935	3575	3612	640	94.5%	37	5.5%
Hana Hwy at Kaahumanu Av	AM	3055	3835	3902	780	92.1%	67	7.9%
	PM	3990	5105	5209	1115	91.5%	104	8.5%
Puunene Av at Maui Mall North	AM	1240	1415	1395	175	112.9%	-20	-12.9%
	PM	1740	2015	1940	275	137.5%	-75	-37.5%
Puunene Av at Maui Mall South	AM	1345	1535	1512	190	113.8%	-23	-13.8%
	PM	1745	2035	1957	290	136.8%	-78	-36.8%
Puunene Av at Kamehameha Av	AM	2390	2880	3023	490	77.4%	143	22.6%
	PM	3285	4115	4367	830	76.7%	252	23.3%
Puunene Av at Wakea Av	AM	2420	2805	3023	385	63.8%	218	36.2%
	PM	2785	3355	3731	570	60.3%	376	39.7%
Lono Av at Vevau St	AM	710	815	1055	105	30.4%	240	103.1% (5)
	PM	990	1185	1702	195	27.4%	517	109.1% (5)
Lono St at Kamehameha Av	AM	1145	1315	1427	170	60.3%	112	39.7%
	PM	1615	2055	2199	440	75.3%	144	24.7%
Lono Av at Wakea Av	AM	1905	2190	2273	285	77.4%	83	22.6%
	PM	1965	2285	2368	320	79.4%	83	20.6%
School St at Kamehameha Av	AM	610	800	800	190	100.0%	0	0.0%
	PM	885	1180	1180	295	100.0%	0	0.0%
Kane St at Kamehameha Av	AM	785	990	990	205	100.0%	0	0.0%
	PM	1430	1995	1995	565	100.0%	0	0.0%
Kane St at Vevau St	AM	675	775	868	100	51.8%	93	48.2%
	PM	1030	1165	1534	135	26.8%	369	73.2%

Notes:
(1) Volumes shown are total intersection approach volumes or projections.
(2) Background versus existing.
(3) Background plus project versus background.
(4) Project generated traffic
(5) Background traffic projections are less than existing traffic volumes because traffic is redistributed as a result of converting Vevau Street from two-way to one-way between Kane Street and Vevau Street. This redistribution of traffic results in negative percentages for growth between existing and 2012 background. This anomaly distorts the calculations to indicate that the growth as a result of project generated traffic is greater than 100%.

Methodology for Level-of-Service Analysis

1. As previously noted, State Department of Transportation (Honolulu) has requested the Synchro software package be used to performed level-of-service analyses. Accordingly, Synchro 6 was used to calculate the traffic signal timings. The timings were then downloaded into the Highway Capacity Software to calculate the levels-of-service of the signalized intersections. Both software packages are based on the *Highway Capacity Manual*.

2. Only the overall intersection levels-of-service are shown in the following level-of-service tables. This is a departure from past presentations where the results for the overall intersection and each controlled lane group was shown. Detailed results indicating the results of the level-of-service analysis for each movement is presented in the appendices.

3. Neither Synchro nor the Highway Capacity Software results report a volume-to-capacity ratio for unsignalized intersections or results for the overall intersection. Shown in the following tables are the delay and level-of-service of the worse movement of the unsignalized intersection. This is consistent with the *Highway Capacity Manual* methodology for unsignalized intersections.

4. In the past, the LA Department of Transportation standard was used to determine the significance of the impacts of project generated traffic. SDOT has consistently responded that they prefer to use the engineering judgement and discretion of their staff to assess the traffic impacts of a project and the effectiveness of possible mitigation measures, along with the standards of the Institute of Transportation Engineers . Accordingly, we have used the Institute of Transportation Engineers standard that a Level-of-Service D is the minimum acceptable level-of-service and that the criteria is applicable to the overall intersection rather than each controlled lane group. If project generated traffic causes the level-of-service to drop below Level-of-Service D, then mitigation should be provided to improve the level-of-service to Level-of-Service C or better. If the Level-of-Service is E or F without project generated traffic and project generated traffic causes the delay of increase, then mitigation should be provided to improve the delay to be equal to or less than the delay for background without project conditions.

5. As the *Highway Capacity Manual* defines level-of-service by delay, we have used the same definitions.

Results of Level-of-Service Analysis

The results of the level-of-service analysis are summarized in Table 14. For the signalized intersections, the volume-to-capacity ratio, control delay and level-of-service for the overall intersection is shown for each intersection. For the unsignalized intersections, the control delay and the level-of-service of the movement with the lowest level-of-service is shown. The results of the level-of-service analysis is discussed separately for each movement.

Table 14 2012 Levels-of-Service

1. Kaahumanu Avenue at Wakea Avenue

During the morning peak hour, the intersection will operate at Level-of-Service C without and with project traffic. During the afternoon peak hour, the intersection will operate at Level-of-Service C without the project and with the project. As the intersection will operate at Level-of-Service C or better during both peak periods, no mitigation is recommended.

2. Kaahumanu Avenue at Kahului Beach Road and Kane Street

This intersection will operate at Level-of-Service F during both peak periods, without and with project related traffic. It should be noted that the intersection currently operates at Level-of-Service F during the morning peak hour and Level-of-Service D during the afternoon peak hour as indicated in Chapter 2. Improvement of this intersection has been recommended as part of the MCC Student Housing and Kane Street Mixed Use Projects. The recommended improvements were reassessed in response to comments from SDOT. The recommended improvements are described in the following chapter.

4. Kaahumanu Avenue at Lono Avenue

This intersection will operate at Level-of-Service C during the morning peak hour, but will operate at Level-of-Service F during the afternoon peak hour, without and with project generated traffic. During the afternoon peak hour, the control delay will increase from 28.2 seconds per vehicle to 91.9 seconds per vehicle. It is recommended that the northbound approach be modified to provide one northbound to westbound left turn lane and a optional left, through and right turn lane.

5. Kaahumanu Avenue at Kinau Avenue

This intersection is a stop sign controlled intersection. Therefore, the delays and levels-of-service shown are for the movement with the lowest level-of-service. As part of the pre-consultation with SDOT at the start of this project, it was decided that signalization of this intersection was not a viable option. It was decided that left turns from the Kahului Town Center would be prohibited in the interest of safety and maintaining an acceptable level-of-service. Therefore, it is the southbound approach that will operate at Level-of-Service F and not traffic exiting the project. Traffic exiting the project will operate a Level-of-Service C during both peak periods and traffic turning left into the project will operate at Level-of-Service C during both peak periods. It was determined that restricting traffic movements of the southbound approach to right turns only was not viable at this time but should be considered in the future if an opportunity arises.

6. Kaahumanu Avenue at Puunene Avenue

During the morning peak hour, this intersection will operate at Level-of-Service C, without and with the project. During the afternoon peak hour, the intersection will operate at Level-of-Service F, without and with the project. It is recommended that the northbound approach be modified to provide an additional northbound to westbound left turn lane. The northbound approach will have two left turn only lanes plus an optional through and right turn lane.

7. Kaahumanu Avenue at Maui Mall

This intersection will operate at Level-of-Service B during the morning peak hour and Level-of-Service C during the afternoon peak hour. No mitigation is recommended.

8. Hana Highway at Kamehameha Avenue and Hobron Avenue

This intersection will operate at Level-of-Service D during the morning peak hour, without and with the project, and Level-of-Service F during the afternoon peak hour. It is recommended that the northbound approach of Kamehameha Avenue be modified to provide an additional northbound to eastbound right turn lane.

9. Puunene Avenue at Maui Mall North and Drive E

This intersection is unsignalized. The delays and levels-of-service shown are the delays and levels-of-service of the movement with the highest delay and lowest level-of-service, which is the westbound approach. During pre-consultation meetings, it was determined that left turns out of the project should be prohibited in the interest of pedestrian safety. Traffic exiting the project is restricted to right turns only and will operate at Level-of-Service B during both peak periods. Traffic turning left into the project from Puunene Avenue will operate at level-of-service A during both peak periods. When possible, traffic using the east lag of this intersection should be restricted to right turns in and out. The levels-of-service would then be comparable to those of traffic entering and exiting the project site.

10. Puunene Avenue at Town Center Drive

This intersection is also unsignalized. The delays and levels-of-service shown are the delays and levels-of-service of the movement with the highest delay and lowest level-of-service, which is the westbound approach, which will operate at Level-of-Service F, without and with. Traffic entering and exiting the project will operate at Level-of-Service C, or better during both peak periods. When possible, traffic using the east lag of this intersection should be restricted to right turns in and out. The levels-of-service would then be comparable to those of traffic entering and exiting the project site.

11. Puunene Avenue at Kamehameha Avenue

This intersection will operate at Level-of-Service C during the morning peak hour, without and with project traffic. During the afternoon peak hour, the level-of-service will decrease from Level-of-Service D without project traffic to Level-of-Service E with project traffic. It recommended that the westbound approach be modified to provide an additional westbound to southbound left turn, that the left turn storage lane be lengthened and that the existing right turn only lane be modified to allow an optional through movement or right turn.

12. Puunene Avenue at Wakea Avenue

During the morning and afternoon peak periods, this intersection will operate at Level-of-Service D without and with the project traffic during both peak periods. No mitigation is recommended.

13. Lono Avenue at Town Center Drive and Vevau Street

This intersection will operate at Level-of-Service D during the morning peak hour. During the afternoon peak hour, the intersection will operate at Level-of-Service F without and with project traffic. It is recommended that the intersection be converted to a four-way stop sign controlled intersection. As a four-way stop sign controlled intersection, the level-of-service will still be Level-of-Service F, but the control delay will decrease. Not only will this improvement significantly reduce to control delay, but it will facilitate pedestrian crossings between the Kahului Town Center and MCC Student Housing projects and enhance pedestrian safety.