

Appendix H

Traffic Impact Analysis Report, Keālia Mauka Homesites

Draft Final

Austin Tsutsumi & Associates, Inc.

May 10, 2019

TRAFFIC IMPACT ANALYSIS REPORT KEALIA MAUKA HOMESITES

Kealia, Kauai, Hawaii

DRAFT FINAL

May 10, 2019

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DRAFT FINAL
TRAFFIC IMPACT ANALYSIS REPORT
KEALIA MAUKA HOMESITES
Kealia, Kauai, Hawaii

1. 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 Kealia Mauka Homesites in Kealia, Kauai, Hawaii (hereinafter referred to as the "Project"). This Traffic Impact Analysis Report (TIAR) is being prepared for inclusion in an Environmental Impact Study (EIS) with the intent to pursue a State Land Use District Boundary Amendment.

1.1 Location

The Project is located in Kealia on approximately 50 acres of land on the east side of the island of Kauai. The Project is north of Kaa Road and is bounded by Kuhio Highway to the east. See Figure 1.1 for the Project location.

1.2 Project Description

The Project proposes to develop 235 single-family dwellings in the Kealia area. Access to the Project will be provided via Kealia Road from Kuhio Highway. The Project will construct a new four-way, one-lane roundabout north of the Kealia Road/Hopoe Road intersection to connect Kealia Road to the Project site. Both the southern and western approaches of the roundabout will have connections to Kealia Road. Although there is currently a direct access to Kuhio Highway along the Makai side of the Project site, this access will be fully removed during Project construction. Construction and occupancy of homes in the proposed subdivision is anticipated in 2027.

See Figure 1.2 for the proposed Project site plan.



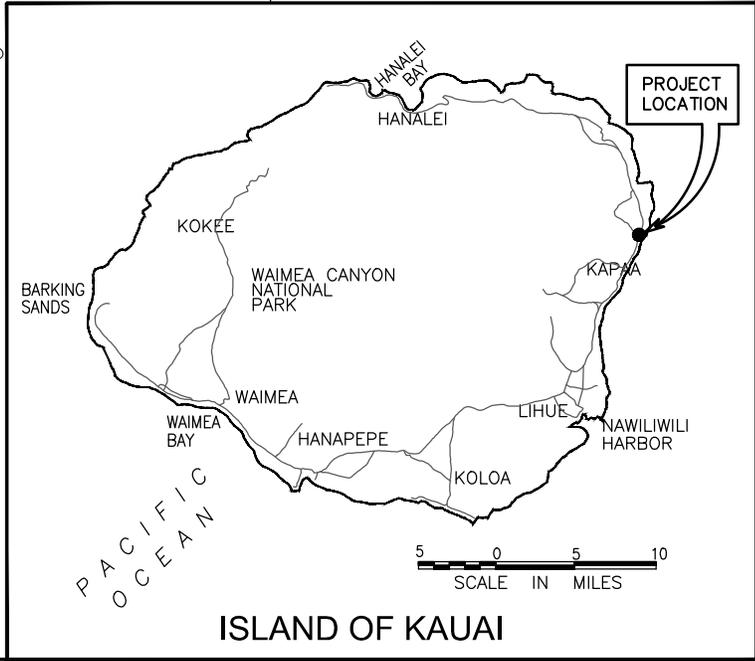
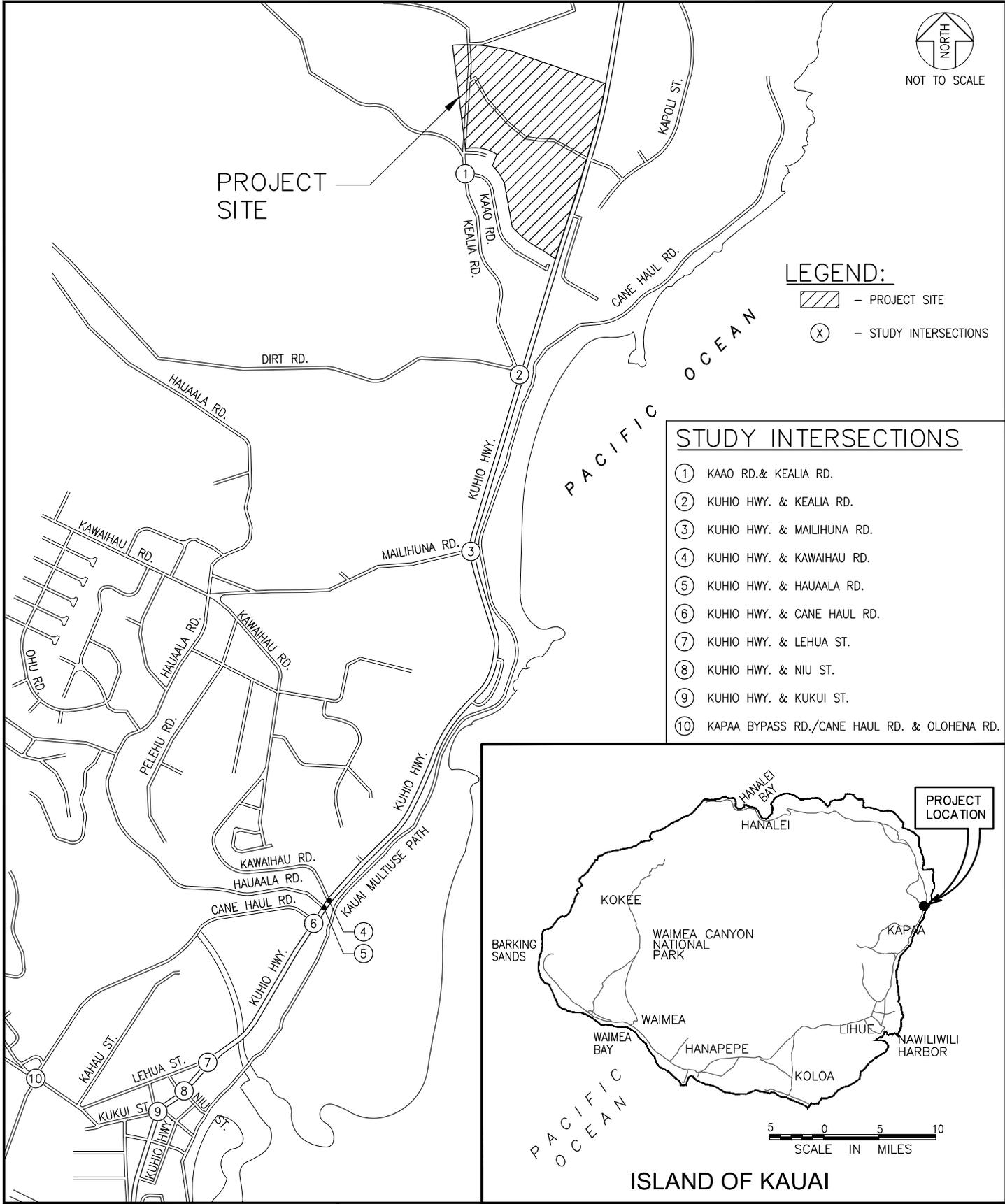
PROJECT SITE

LEGEND:

- PROJECT SITE
- STUDY INTERSECTIONS

STUDY INTERSECTIONS

- ① KAAO RD. & KEALIA RD.
- ② KUHIO HWY. & KEALIA RD.
- ③ KUHIO HWY. & MAILIHUNA RD.
- ④ KUHIO HWY. & KAWAIHAU RD.
- ⑤ KUHIO HWY. & HAUAAALA RD.
- ⑥ KUHIO HWY. & CANE HAUL RD.
- ⑦ KUHIO HWY. & LEHUA ST.
- ⑧ KUHIO HWY. & NIU ST.
- ⑨ KUHIO HWY. & KUKUI ST.
- ⑩ KAPAA BYPASS RD./CANE HAUL RD. & OLOHENA RD.



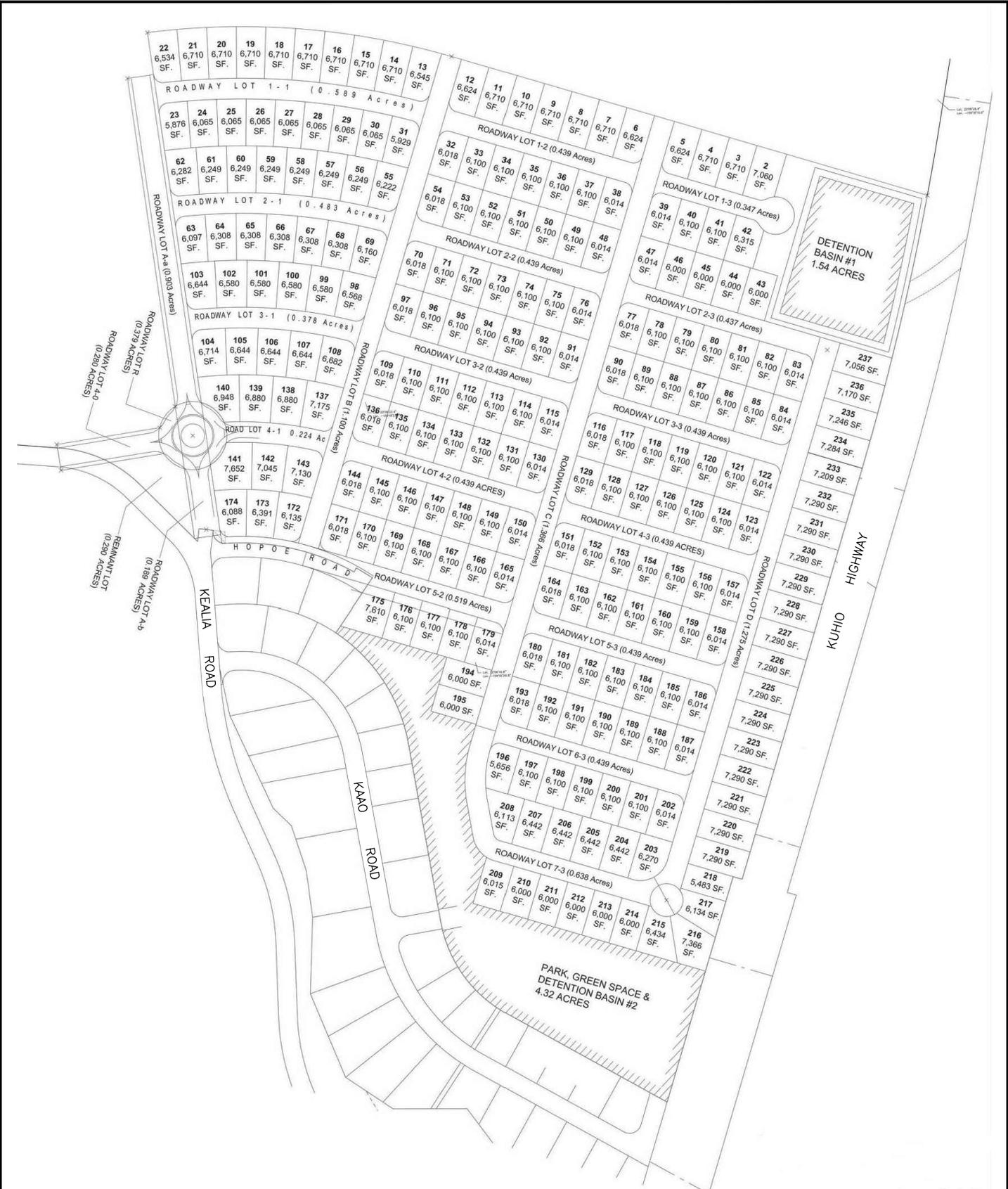
KEALIA MAUKA HOMESITES
TIAR

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

FIGURE

LOCATION MAP

1.1



Source: Kodani

KEALIA MAUKA HOMESITES
TIAR

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

SITE PLAN

FIGURE
1.2



2. METHODOLOGY

2.1 Study Methodology

This study will address the following:

- Assess existing traffic operating conditions and parking at key intersections during the weekday morning (AM) and afternoon (PM) peak hours of traffic within the study area.
- Traffic projections for Base Year 2027 (without the Project) including traffic generated by other known developments in the vicinity of the Project in addition to an ambient growth rate. These other known developments are projects that are currently under construction or known new/future developments that are anticipated to affect traffic demand and operations within the study area.
- Trip generation and traffic assignment characteristics for the proposed Project.
- Traffic projections for Future Year 2027 (with the Project), which includes Base Year traffic volumes in addition to traffic volumes generated by the Project.
- Recommendations for Base Year as well as Future Year roadway improvements or other mitigative measures, as appropriate, to reduce or eliminate the adverse impacts resulting from traffic generated by known developments in the region or the Project.

2.2 Intersection Analysis

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 (HCM), 6th Edition, dated 2016, includes methods for calculating volume to capacity ratios, delays, and corresponding Levels of Service that were utilized in this study. LOS definitions for signalized and unsignalized intersections are provided in Appendix B.

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



3. EXISTING CONDITIONS

3.1 Roadway System

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

Kuhio Highway – is generally a north-south, two-way, two-lane principal arterial in the vicinity of the Project. The roadway begins in Lihue at its connection with Kaunualii Highway and travels along the coast before terminating at Kee Beach in Haena. Kuhio Highway is a State roadway and is the major thoroughfare in the East Kauai regions. In the vicinity of the Project, Kuhio Highway has a posted speed limit of 25 to 50 miles per hour (mph) depending on the surrounding land uses. In the immediate vicinity of the Project, the highway has a speed limit of 50 mph in the northbound direction and 40 mph in the southbound direction.

Kealia Road – is generally a northwest-southeast, two-way, two-lane roadway in the vicinity of the Project. The roadway begins at its intersection with Kuhio Highway in the east and extends to the northwest to its intersection with Hauaala Road at Spaulding Monument. Access between Hauaala Road and Kealia Road is impassable at this location. The roadway then travels to the northeast where it reconnects to Kuhio Highway in Anahola. However, this section of Kealia Road is unimproved. In the vicinity of the Project, Kealia Road has a posted speed limit of 25 mph.

Kaao Road – is generally an east-west, two-way, two-lane roadway in the vicinity of the Project. The roadway begins at its intersection with Kealia Road to the west and travels to the east to provide access to the existing residential neighborhood. In the vicinity of the Project, Kaao Road has a posted speed limit of 15 mph.

Mailihuna Road – is generally an east-west, two-way, two-lane roadway in the vicinity of the Project. The roadway begins to the east at its intersection with Kuhio Highway and terminates to the west at its intersection with Kawaihau Road. Mailihuna Road provides access to Kapaa High School and residential areas. In the vicinity of the Project, Mailihuna Road has a posted speed limit of 25 mph which drops to 15 mph near Kapaa High School.

Kawaihau Road – is generally an east-west, two-way, two-lane roadway in the vicinity of the Project. The roadway begins to the east at its intersection with Kuhio Highway and terminates to the west at its intersection with Kahuna Road and Pililiamoo Road. Kawaihau Road provides access to Kapaa High School, Kapaa Elementary School and residential areas. In the vicinity of the Project, Kawaihau Road has a posted speed limit of 25 mph.

Hauaala Road – is generally an east-west, two-way, two-lane roadway in the vicinity of the Project. The roadway begins to the east at its intersection with Kuhio Highway and terminates to the northwest at its intersection with Kealia Road. Hauaala Road provides access to residential areas. In the vicinity of the Project, Hauaala Road has a posted speed limit of 25 mph.

Cane Haul Road – is generally a north-south, one-way, one-lane roadway in the vicinity of the Project. The roadway begins to the northeast at its intersection with Kuhio Highway and terminates to the south at the roundabout on Olohena Road where it connects to the two-way Kapaa Bypass Road. The roadway provides travel in the southbound direction only. In the vicinity of the Project, Cane Haul Road has a posted speed limit of 25 mph.



Kapaa Bypass Road – is generally a north-south, two-way, two-lane roadway in the vicinity of the Project. The roadway begins to the north at the roundabout on Olohena Road where it connects to the one-way Cane Haul Road and terminates to the south at its intersection with Kuhio Highway in Wailua. The approximately three (3) mile long bypass road provides an alternate route to Kuhio Highway for travelers passing through Kapaa and Waipouli. In the vicinity of the Project, Kapaa Bypass Road has a posted speed limit of 25 to 35 mph.

Olohena Road – is generally an east-west, two-way, two-lane roadway in the vicinity of the Project. The roadway begins to the east at its connection with Kukui Street and terminates to the west at its intersection with Waipouli Road and the Moalepe Trail. Olohena Road provides access to Kapaa Middle School. In the vicinity of the Project, Olohena Road has a posted speed limit of 25 mph.

Lehua Street – is generally an east-west, two-way, two-lane roadway in the vicinity of the Project. The roadway begins to the east at its intersection with Kuhio Highway and terminates to the west at its intersection with Olohena Road. In the vicinity of the Project, Lehua Street has a posted speed limit of 25 mph.

Niu Street – is generally a northwest-southeast, two-way, two-lane roadway in the vicinity of the Project. The roadway begins to the northwest at its intersection with Lehua Street and terminates to the southeast at the Ke Ala Hele Makalae Multi-Use Path. There is no posted speed limit in the vicinity of the Project.

Kukui Street – is generally an east-west, two-way, two-lane roadway in the vicinity of the Project. The roadway begins to the west at its connection with Olohena Road and terminates to the east at the Ke Ala Hele Makalae Multi-Use Path. In the vicinity of the Project, Kukui Street has a posted speed limit of 15 mph.

Huluili Street – is generally a north-south, one-way, one-lane roadway in the vicinity of the Project. The roadway begins to the south at its intersection with Kuhio Highway and Kukui Street and terminates to the north at its intersection with Lehua Street. The roadway provides travel in the northbound direction only. There is no posted speed limit in the vicinity of the Project.

3.2 Sustainable Transportation

3.2.1 Complete Streets

While transportation planning has traditionally focused on automobile travel, recent “Complete Streets” policies also recognize the numerous benefits of encouraging the use of alternative modes of transportation. “Complete Streets” policies encourage the provision of equitable, accessible and safe transportation for all modes.

Hawaii State Senate Bill 718 (2009) required that the Hawaii Department of Transportation (HDOT) and the County transportation departments:

“...adopt a complete streets policy that seeks to reasonably accommodate convenient access and mobility for all users of the public highways within their respective jurisdictions...”

3.2.2 Pedestrian Accessibility

In the vicinity of the Project, sidewalks are provided on both sides of the road along Kuhio Highway from the Kuhio Highway/Kukui Street intersection to just north of the Kuhio Highway/Lehua Street intersection. Sidewalks are also provided along the mauka side of Kuhio Highway from Lehua Street to Kawaihau Road and from the Kapaa Stream Bridge to Kealia Road. It should be noted that improvements are currently planned for the Kapaa Stream Bridge and will include extending the sidewalk across the bridge to Mailihuna Road.

A generally narrow and at times overgrown asphalt path is also provided along Mailihuna Road and provides access to Kapaa High School from the highway. Beyond Kapaa High School and Elementary School, the Kawaihau Bike Path, designated as a shared use path for bicyclists and pedestrians, provides access through the residential area up to Kapahi Park. This shared use path is generally narrow and unimproved. Along Olohena Road at the roundabout, a sidewalk is provided along the mauka bound direction and eventually transitions into an asphalt path separated from the roadway by a guardrail. Near Kapaa Middle School, the sidewalk transitions to the makai bound direction of the roadway.

In addition to the existing and planned sidewalks, the Ke Ala Hele Makalae Multi-Use Path provides a pedestrian and bicycle route as an alternative to travel along Kuhio Highway. The multi-use path begins at Lihi Park in Kapaa and travels north to Kuna Bay in Kealia on the Makai side of Kuhio Highway. The Ke Ala Hele Makalae Multi-Use Path also has a Kawaihau Road spur that provides access from the main pathway to the Mahelona Medical Center, Kapaa Elementary School and Kapaa High School.

Figure 3.1 shows the existing pedestrian facilities in the vicinity of the Project and the major destinations in the study area.

Minimal pedestrian activity was observed along Kuhio Highway in the study area. Pedestrian activity was observed to be higher near the Lehua Street, Niu Street and Kukui Street intersections with the highway due to significant amounts of on-street parking and commercial spaces in the area. The majority of pedestrians in the area were observed to travel along the Ke Ala Hele Makalae Multi-Use Path rather than along Kuhio Highway.

Some pedestrian activity was observed along Kealia Road. Although no sidewalks are currently provided along the roadway, pedestrians occasionally travel between the existing residential areas along Kealia Road and the post office, food truck area and farmers market located near Kuhio Highway. In addition, walkers, runners and bicyclists regularly use the roadway to access Spaulding Monument, located at the mauka end of Kealia Road, for fitness and recreation.

3.2.3 Bicycle Accessibility

HDOT currently provides the Bike Plan Hawaii Master Plan, which identifies existing and proposed bicycle routes that could potentially be implemented in the future. In the vicinity of the Project, the Ke Ala Hele Makalae Multi-Use Path provides pedestrian and bicycle accessibility through Kapaa and Kealia as described in the previous section. Additionally, the Kawaihau Bike Path provides a 3.0 mile long shared use path from Kapaa Elementary School to Kapahi Park. Along Olohena Road, a bike lane is provided in the mauka bound direction of the roadway and a signed shared use is designated in the makai bound direction between the roundabout and Kapaa Middle School.

Figure 3.2 shows the existing bicycle facilities in the vicinity of the Project and the major destinations in the study area.

A total of 20 bicycle routes/upgrades are proposed for the Kawaihau region of East Kauai. In the vicinity of the Project, five (5) signed shared roadways and two (2) bicycle paths are proposed.

- Signed Shared Road – Kuhio Highway from the Kealia region to the Anahola region (Priority Level II)
- Signed Shared Road – Kuhio Highway from the Wailua region to the Kealia region (Priority Level II)
- Signed Shared Road – Kealia Road from the Koolau region to Kuhio Highway (Priority Level III)
- Signed Shared Road – Mailihuna Road from Kawaihau Road to Kuhio Highway (Priority Level III)
- Signed Shared Road – Olohena Road/Kukui Street from Kamalu Road to Kuhio Highway (Priority Level III)
- Bike Path – Extension of the Ke Ala Hele Makalae Multi-Use Path from Kuna Bay to the Anahola region (Priority Level I)
- Bike Path – Upgrade of the Kawaihau Bike Path from Kapaa Elementary School to Kapahi Park

Minimal, if any, bicycle activity was observed along Kuhio Highway in the study area. However, several bicyclists were observed to travel along the Ke Ala Hele Makalae Multi-Use Path.

Some bicyclists use Kealia Road to access Spaulding Monument, located at the mauka end of Kealia Road, for fitness and recreation.

3.2.4 Public Transit

The Kauai Bus public transit system offers several routes that provide service from Kekaha to Hanalei. Routes 400 and 500 serve Hanalei to Lihue and Lihue to Hanalei, respectively, providing stops at the Kuhio Highway/Kealia Road intersection and at several other locations along Kuhio Highway. Additionally, Route 60 provides service within the Kapaa region. This route has several stops along Kuhio Highway between the Kuhio Highway/Kukui Street and Kuhio Highway/Kawaihau Road intersections and along Kawaihau Road. Buses run every hour throughout the day.

Figure 3.3 shows the existing transit stops and routes in the vicinity of the Project and the major destinations in the study area.

3.3 Existing Traffic Volumes

The hourly turning movement data utilized in this report were collected on April 18-19, 2017. Based on the proximity to the proposed Project site, the following intersections were studied in the existing conditions scenario.

- [1] Kaa Road/Kealia Road (unsignalized)
- [2] Kuhio Highway/Kealia Road (unsignalized)



- [3] Kuhio Highway/Mailihuna Road (unsignalized)
- [4] Kuhio Highway/Kawaihau Road (unsignalized)
- [5] Kuhio Highway/Hauaala Road (unsignalized)
- [6] Kuhio Highway/Cane Haul Road (unsignalized)
- [7] Kuhio Highway/Lehua Street (unsignalized)
- [8] Kuhio Highway/Niu Street (unsignalized)
- [9] Kuhio Highway/Kukui Street (signalized)
- [10] Kapaa Bypass Road/Cane Haul Road/Olohena Road (roundabout)

Note that for intersection [10] Kapaa Bypass Road/Cane Haul Road/Olohena Road, turning movement data was obtained from the 2015 Kapaa Transportation Solutions report and calibrated to collected existing conditions data. Based on the count data, it was determined that the AM peak hour of traffic occurs between 7:15 AM and 8:15 AM and the PM peak hour of traffic occurs between 3:45 PM and 4:45 PM. The turning movement count data is included in Appendix A.

The weekday AM peak hour of traffic generally coincided with the start times of Kapaa Elementary School, Kapaa Middle School and Kapaa High School, which are located in the vicinity of the Project. Although a midday peak hour of traffic was observed from 2:15 PM to 3:15 PM coinciding with the end times of the nearby schools, the midday volumes were generally lower than the AM and PM peak hour volumes and were not included in this report. Table 3.1 shows the start and end times for each of the schools.

Table 3.1: Nearby Schools Start and End Times

	Kapaa Elementary School		Kapaa Middle School		Kapaa High School	
	Start	End	Start	End	Start	End
Monday	7:45 AM	2:00 PM	8:00 AM	2:55 PM	8:00 AM	3:00 PM
Tuesday	7:45 AM	2:00 PM	8:05 AM	2:17 PM	8:00 AM	3:00 PM
Wednesday	7:45 AM	1:15 PM	8:00 AM	2:16 PM	8:00 AM	3:00 PM
Thursday	7:45 AM	2:00 PM	8:00 AM	2:17 PM	8:00 AM	3:00 PM
Friday	7:45 AM	2:00 PM	8:00 AM	2:55 PM	8:00 AM	3:00 PM

3.4 Existing Traffic Conditions Observations and Analysis

Traffic conditions described as current and on-going in this report are based on field observations collected during the data collection period.

3.4.1 Regional Analysis

Kuhio Highway serves as the main thoroughfare for regional traffic in East Kauai. On Monday through Saturday from 7:00 AM to 1:30 PM, Kuhio Highway is contra flowed to provide two (2) southbound lanes and one (1) northbound lane from the Kapaa Bypass south junction to Kapule



Highway to serve heavier southbound volumes. Figure 3.4 shows the location of the Kuhio Highway contraflow in the vicinity of the Project.

During the AM and PM peak hours of traffic, volumes along Kuhio Highway are generally balanced in both the northbound and southbound directions within the Project vicinity. During the AM peak hour, southbound traffic is generally higher. However, with approximately one-third of the AM southbound traffic utilizing Kapaa Bypass Road, the traffic volumes along Kuhio Highway are generally balanced during both the AM and PM peaks.

Within the region, queuing along southbound Kuhio Highway was observed to occur during the PM peak hour when contraflow operations were not in place. The queues generally extended approximately 1.25 miles from Kuamoo Road to near Kamoia Road. Occasionally, queues were observed to also form along southbound Kapaa Bypass Road during the PM peak hour. These queues extended approximately 0.4 miles from Kuhio Highway to Pouli Road. Figure 3.5 shows the regional queues observed during existing conditions.

3.4.2 Existing Intersection Analysis

The observations and analysis described below are based on prevailing observations 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.

Within Kapaa Town, queuing was observed during both the AM and PM peak hours of traffic. Queues began near the Kuhio Highway/Kawaihau Road intersection and extended in both the northbound and southbound directions. During both peak hours, southbound queues extended to Fire Station 8 (approximately 0.5 miles), and northbound queues extended to Kukui Street (approximately 0.55 miles). Queuing during the AM peak hour was mainly the result of traffic from the nearby Kapaa High School and Kapaa Elementary School.

Study intersections were analyzed using the traffic analysis software Synchro. Because Synchro does not report LOS for uncontrolled movements at unsignalized intersections, LOS is not given for the through movements along Kuhio Highway. Therefore, existing congestion along Kuhio Highway at the study intersections is based solely on observations at the time of the traffic counts.

[1] Kaa Road/Kealia Road

This intersection served 46(62) vehicles during the AM(PM) peak hour of traffic. Because of the low volumes utilizing this intersection, all movements operated at LOS A with minimal delay.

[2] Kuhio Highway/Kealia Road

The eastbound approach of this intersection operated at LOS C(C) and the westbound approach operated at LOS E(F) during the AM(PM) peak hour of traffic. Delay to the westbound approach was mainly caused by the larger percentage of vehicles making a left-turn onto Kuhio Highway. However, the number of vehicles making the left-turn was low (≤ 26 vehicles) and adequate gaps were observed along Kuhio Highway to complete the maneuver. The northbound and southbound left-turn movements from Kuhio Highway onto Kealia Road operated at LOS A during both peak hours and experienced minimal delay. Although minor street movements and major street left-turn movements were able to proceed during gaps in



traffic along Kuhio Highway, the high speeds along the highway increased the difficulty of these maneuvers. Along this portion of Kuhio Highway, the posted speed limit is 40 mph in the southbound and 50 mph in the northbound direction. However, southbound speeds were observed to be higher due to a hill on the northbound approach. No congestion along Kuhio Highway was observed at this intersection during either peak hour.

[3] Kuhio Highway/Mailihuna Road

The eastbound approach of this intersection operated at LOS F during both peak hours of traffic and at overcapacity conditions during the AM peak hour because of the high volume of vehicles making the left-turn onto Kuhio Highway. Queues along Mailihuna Road were observed to extend approximately 30 vehicles during the AM peak hour mainly due to the school traffic. The AM congestion on Mailihuna Road was observed to last approximately 50 minutes. Vehicles had difficulty making the eastbound left-turn because of the high speeds of the vehicles on Kuhio Highway. The northbound and left-turn from Kuhio Highway onto Mailihuna Road operated at LOS A during both peak hours and experienced minimal delay. No congestion along Kuhio Highway was observed at this intersection during either peak hour.

[4] Kuhio Highway/Kawaihau Road

The eastbound approach of this intersection operated at LOS F(C) and the northbound left-turn movement operated at LOS B(B) during the AM(PM) peak hour of traffic. Because of the high volume of eastbound right-turns and northbound left-turns, the vehicles heading southbound along Kuhio Highway often stopped to allow these vehicles to proceed, and the intersection was observed to self-regulate and operate similar to an all-way stop controlled intersection during the heaviest periods of congestion. It was observed that on average every four (4) southbound through vehicles would yield to either the northbound left-turn or eastbound left or right-turn. During less congested periods, minor movements were able to use gaps in traffic to proceed. Because of the large number of turning movements at this intersection and the proximity of this intersection to the Kuhio Highway/Hauaala Road intersection, Kuhio Highway became congested in this area in both the northbound and southbound directions.

[5] Kuhio Highway/Hauaala Road

The eastbound approach of this intersection operated at LOS F(D) and the northbound left-turn movement operated at LOS B(B) during the AM(PM) peak hour of traffic. Additionally, the eastbound approach operated under overcapacity conditions during the AM peak hour. Operations at this intersection behaved similarly to the Kuhio Highway/Kawaihau Road intersection.

[6] Kuhio Highway/Cane Haul Road

Because Cane Haul Road is one-way and does not allow traffic to enter Kuhio Highway, minimal delay was observed at this intersection. Many vehicles were observed to make a southbound right-turn onto Cane Haul Road in order to access the Kapaa Bypass Road. The majority of Kuhio Highway congestion in the southbound direction cleared in the vicinity of this intersection. However, congestion in the northbound direction remained due to queues extending from the Kuhio Highway/Kawaihau Road and Kuhio Highway/Hauaala Road intersections.

[7] Kuhio Highway/Lehua Street

The eastbound approach of this intersection operated at LOS F and overcapacity during both peak hours of traffic. Because Kapaa Bypass Road terminates at the Olohena Road roundabout, vehicles heading farther north must reenter Kuhio Highway. The majority of these vehicles use Lehua Street to make a left-turn onto Kuhio Highway in order to avoid delay from the signal at Kukui Street. Although a refuge lane is provided for vehicles making the left-turn and there are adequate gaps in the southbound traffic, the high volume of left-turns caused increased delay for the eastbound approach. At this intersection, congestion was observed along Kuhio Highway in the northbound direction due to queues extending from the Kuhio Highway/Kawaihau Road and Kuhio Highway/Hauaala Road intersections during both peak hours of traffic.

[8] Kuhio Highway/Niu Street

The eastbound approach of this intersection operated at LOS E(C) and the westbound approach operated at LOS C(C) during the AM(PM) peak hours of traffic. The minor street and major street left-turn movements were observed to experience minimal delay because of adequate gaps in traffic created by the nearby Kukui Street signal. At this intersection, congestion was observed along Kuhio Highway in the northbound direction due to queues extending from the Kuhio Highway/Kawaihau Road and Kuhio Highway/Hauaala Road intersections.

[9] Kuhio Highway/Kukui Street

The minor street movements operated at LOS F(D) during the AM(PM) peak hours of traffic. Delay to the minor movements was mainly caused by the long coordinated signal favoring the Kuhio Highway through movements. All movements were observed to generally clear in one (1) cycle. However, during the most congested AM and PM periods, queues extending from the Kuhio Highway/Kawaihau Road and Kuhio Highway/Hauaala Road intersections caused slow-moving traffic in the northbound direction. Although northbound traffic was slow-moving, vehicles were only occasionally unable to proceed through the intersection because of queue spill back. During these events, vehicles were generally still able to clear the intersection in one (1) cycle. Queues reached the Kuhio Highway/Kukui Street intersection sporadically and lasted for a total of approximately 5-10 minutes during each of the peak hours.

[10] Kapaa Bypass Road/Cane Haul Road/Olohena Road

Based on the Kapaa Transportation Solutions calibrated data, the roundabout generally operates smoothly during the PM peak hour of traffic with all approaches operating at LOS C or better. However, during the AM peak hour, the eastbound approach experiences high volumes due to the large number of vehicles entering Kuhio Highway and Kapaa Bypass Road from residential areas and Kapaa Middle School. During the AM peak hour, the eastbound approach operates at LOS E and near overcapacity conditions. According to the Kapaa Transportation Solutions report, significant queuing occurs on the eastbound approach during the AM peak hour with queues reaching approximately 550 feet.

Figure 3.6 illustrates the local queues observed during existing conditions. Figure 3.3 illustrates the existing lane configurations, volumes and LOS. See Table 3.2 for a summary of the existing conditions analysis.



NOT TO SCALE

PROJECT SITE

KEALIA POST OFFICE
FOOD TRUCKS/
FARMER'S MARKET

DIRT RD.

HAUAALA RD.

KUHIO HWY.

PACIFIC OCEAN

KEALIA BEACH

MAILIHUNA RD.

KAPAA HIGH SCHOOL

KAPAA ELEMENTARY SCHOOL

MAHELENA MEDICAL CENTER

KUHIO HWY.

KAWAIHAU RD.

HAUAALA RD.

CANE HAUL RD.

KAUAU MULTIUSE PATH

APOPO RD.

OLOHENA RD.

MALU RD.

KAPAA MIDDLE SCHOOL

KAPAA TOWN PARK
KAHAU ST.

LEHUA ST.

KUKUI ST.

KUHIO HWY.

NIHUA ST.

LEGEND:

 - PROJECT SITE

 - EXISTING SIDEWALK

 - EXISTING MULTI-USE PATH

KEALIA MAUKA HOMESITES
TIAR



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ENGINEERS, SURVEYORS HONOLULU, HAWAII

FIGURE

EXISTING PEDESTRIAN FACILITIES

3.1



NOT TO SCALE

PROJECT SITE

KEALIA POST OFFICE
FOOD TRUCKS/
FARMER'S MARKET

DIRT RD.

HAUAALA RD.

KAWAIHAU RD.

OHU RD.

HAUAALA RD.

PELEHU RD.

KAWAIHAU RD.

HAUAALA RD.

CANE HAUL RD.

KUHIHO HWY.

APOPO RD.

OLOHENA RD.

MALU RD.

KAPAA TOWN PARK

KAHAU ST.

LEHUA ST.

KUKUI ST.

KUHIHO HWY.

NIH ST.

MAILIHUNA RD.

KAPAA HIGH SCHOOL

KAPAA ELEMENTARY SCHOOL

MAHELENA MEDICAL CENTER

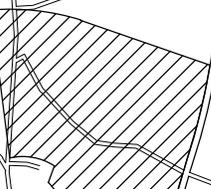
KUHIHO HWY.

KAWAIHAU RD.

HAUAALA RD.

CANE HAUL RD.

KUHIHO HWY.



KAAO RD.

KEALIA RD.

KUHIHO HWY.

MAILIHUNA RD.

KUHIHO HWY.

KAPOLI ST.

CANE HAUL RD.

PACIFIC OCEAN

KEALIA BEACH

LEGEND:



- PROJECT SITE



- EXISTING BIKE LANE



- EXISTING MULTI-USE PATH



- EXISTING SIGNED SHARED ROADWAY

KEALIA MAUKA HOMESITES
TIAR



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FIGURE

EXISTING BICYCLE FACILITIES

3.2



NOT TO SCALE

PROJECT SITE

KEALIA POST OFFICE
FOOD TRUCKS/
FARMER'S MARKET

DIRT RD.

HAUAALA RD.

KUHIO HWY.

PACIFIC OCEAN

KEALIA BEACH

MAILIHUNA RD.

KAPAA HIGH SCHOOL

KAPAA ELEMENTARY SCHOOL

MAHELONA MEDICAL CENTER

KUHIO HWY.

KAWAIHAU RD.

HAUAALA RD.

CANE HAUL RD.

KUHIO HWY.

KAUAI MULTIUSE PATH

APOPO RD.

OLOHENA RD.

MALU RD.

KAPAA MIDDLE SCHOOL

KAPAA TOWN PARK

KAHAU ST.

LEHUA ST.

KUKUI ST.

KUHIO HWY.

KUHIO HWY.

KUHIO HWY.

LEGEND:

 - PROJECT SITE

 - EXISTING BUS STOP

 - ROUTE 400/500

 - ROUTE 60

KEALIA MAUKA HOMESITES
TIAR



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FIGURE

EXISTING TRANSIT FACILITIES

3.3

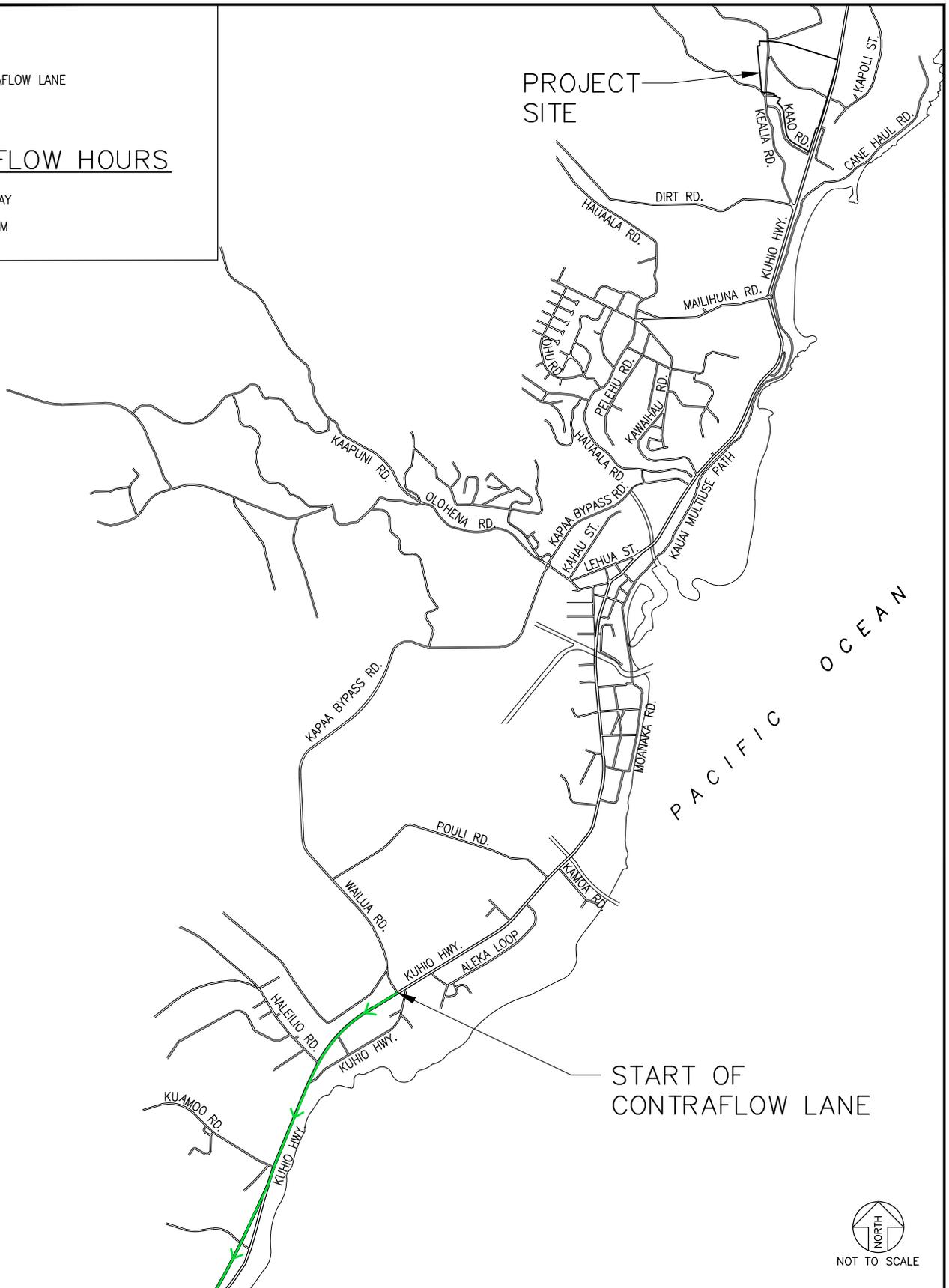
LEGEND

— CONTRAFLOW LANE

CONTRAFLOW HOURS

MONDAY - SATURDAY
7:00 AM - 1:30 PM

PROJECT
SITE



START OF
CONTRAFLOW LANE



NOT TO SCALE

KEALIA MAUKA HOMESITES
TIAR



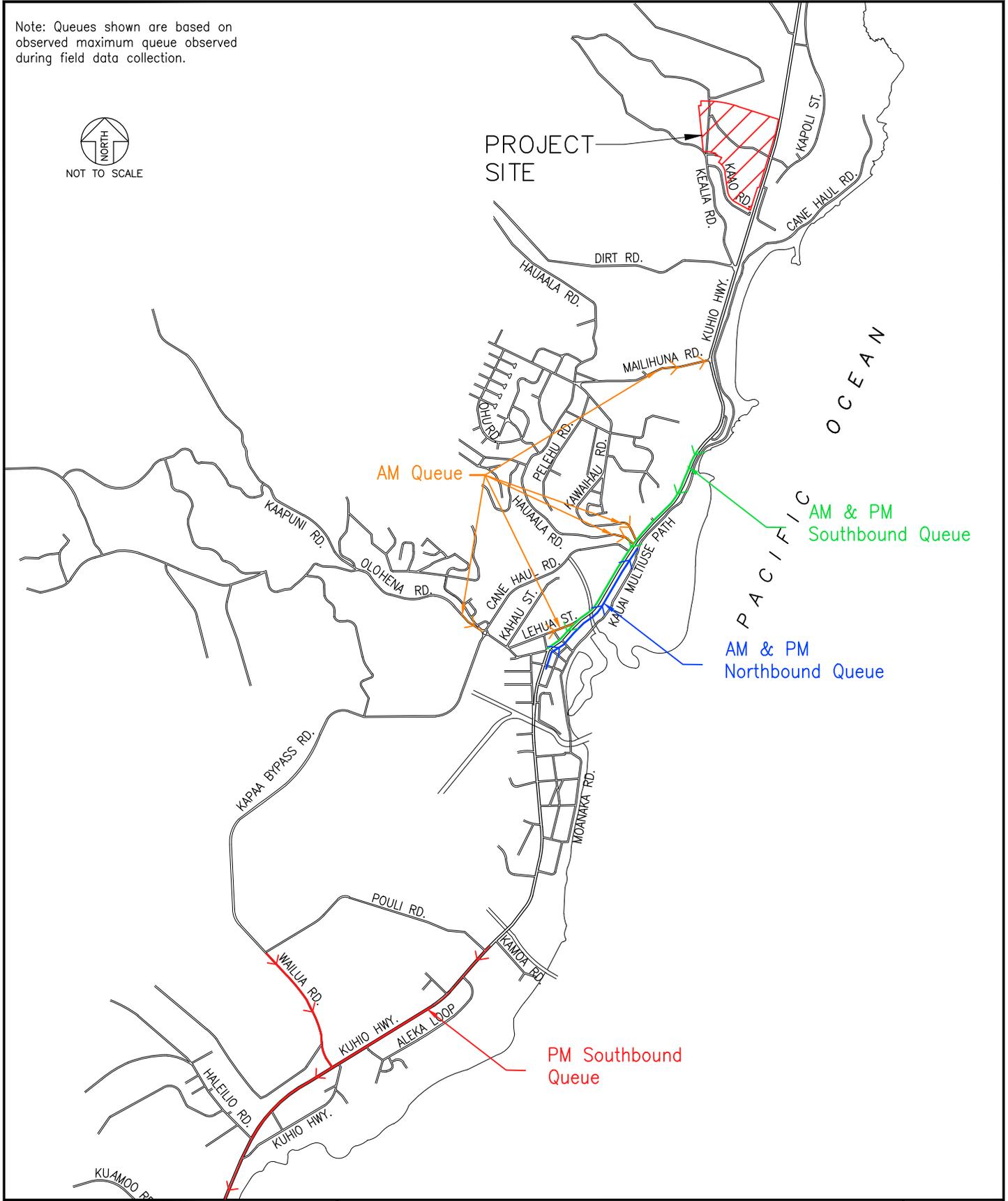
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FIGURE

3.4

KUHIO HIGHWAY CONTRAFLOW

Note: Queues shown are based on observed maximum queue observed during field data collection.



KEALIA MAUKA HOMESITES
TIAR

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EXISTING CONDITION QUEUES

FIGURE
3.5



NOT TO SCALE

NOTE:
THIS DRAWING IS FOR ILLUSTRATIVE PURPOSES ONLY. DO NOT USE FOR CONSTRUCTION.

DATE OF COUNTS:
APRIL 18-19, 2017

AM PEAK HOUR:
7:15 AM - 8:15 AM

PM PEAK HOUR:
3:45 PM - 4:45 PM

LEGEND

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

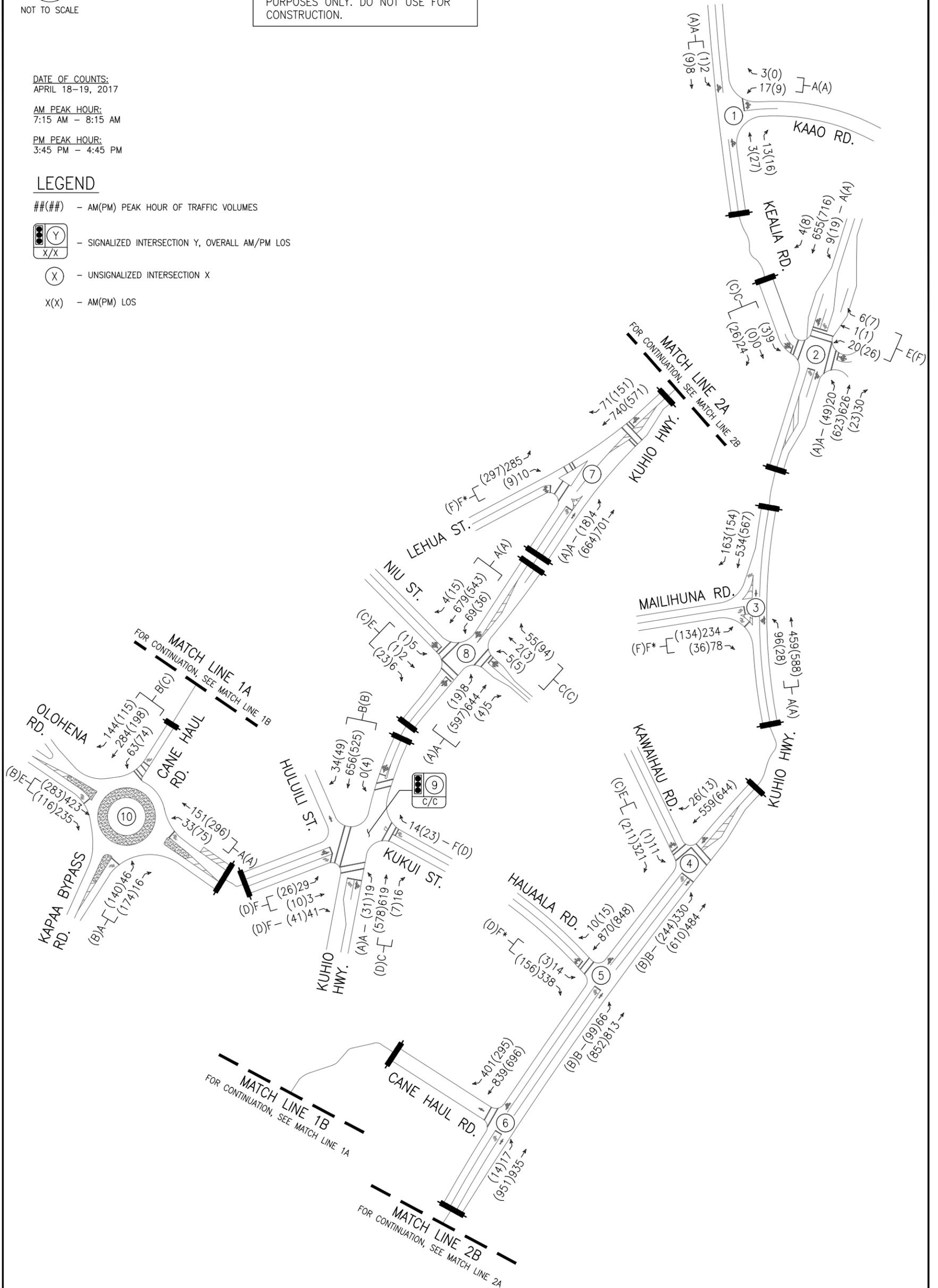


- SIGNALIZED INTERSECTION Y, OVERALL AM/PM LOS



- UNSIGNALIZED INTERSECTION X

X(X) - AM(PM) LOS



KEALIA MAUKA HOMESITES TIARI

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EXISTING LANE CONFIGURATION, VOLUMES AND MOVEMENT LOS

FIGURE
3.6

Table 3.2: Existing Conditions Level of Service Summary

Intersection	Existing Conditions					
	AM			PM		
	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS
1: Kealia Rd & Kaa Rd						
WB LT/RT	9	0.02	A	9	0.01	A
SB LT/TH	7	0.00	A	7	0.00	A
<i>Overall</i>	4	-	-	1	-	-
2: Kuhio Hwy & Kealia Rd						
NB LT	9	0.03	A	10	0.06	A
EB LT/TH/RT	24	0.16	C	20	0.12	C
WB LT/TH/RT	47	0.26	E	77	0.44	F
SB LT	9	0.01	A	9	0.02	A
<i>Overall</i>	2	-	-	3	-	-
3: Kuhio Hwy & Mailihuna Rd						
NB LT/TH	10	0.12	A	10	0.04	A
EB LT/RT	447	1.85	F*	107	0.97	F
<i>Overall</i>	90	-	-	12	-	-
4: Kuhio Hwy & Kawaihau Rd						
NB LT	11	0.38	B	11	0.30	B
EB LT/RT	77	0.98	F	24	0.56	C
<i>Overall</i>	17	-	-	5	-	-
5: Kuhio Hwy & Hauaala Rd						
NB LT	11	0.10	B	11	0.15	B
EB LT/RT	213	1.35	F*	33	0.58	D
<i>Overall</i>	36	-	-	4	-	-
6: Kuhio Hwy & Cane Haul Rd**						
NB LT/TH	1	0.04	A	1	0.02	A
<i>Overall</i>	0	0.72	C	0	0.58	B
7: Kuhio Hwy & Lehua St						
NB LT	10	0.01	A	10	0.02	A
EB LT/RT	98	1.03	F*	87	1.01	F*
<i>Overall</i>	16	-	-	16	-	-
8: Kuhio Hwy & Niu St						
NB LT/TH/RT	9	0.01	A	9	0.02	A
EB LT/TH/RT	46	0.14	E	17	0.08	C
WB LT/TH/RT	23	0.25	C	21	0.33	C
SB LT/TH/RT	10	0.09	A	9	0.05	A
<i>Overall</i>	2	-	-	2	-	-
9: Kuhio Hwy & Kukui St**						
NB LT	2	0.04	A	4	0.06	A
NB TH/RT	33	0.96	C	36	0.95	D
EB LT/TH	96	0.32	F	45	0.15	D
EB RT	92	0.03	F	44	0.03	D
WB RT	92	0.01	F	44	0.02	D
SB LT/TH/RT	11	0.75	B	16	0.75	B
<i>Overall</i>	26	-	C	27	-	C
10: Kapaa Bypass Rd/Cane Haul Rd & Olohena Rd						
NB LT/RT	7	0.10	A	11	0.43	B
EB TH/RT	47	0.95	E	13	0.55	B
WB LT/TH	5	0.18	A	8	0.41	A
SB LT/TH/RT	14	0.62	B	19	0.66	C
<i>Overall</i>	28	-	D	13	-	B

* Denotes overcapacity condition, v/c ≥ 1.

** Intersection analyzed using HCM 2000 methodology due to HCM 6th Edition methodology currently not supporting signalized intersections with a stop-controlled, right-turn only approach or unsignalized intersections without at least one stop-controlled approach.

4. BASE YEAR 2027

Base Year 2027 was selected to reflect the full buildout and occupancy of the Project. The Base Year 2027 scenario represents the traffic conditions within the study area without the Project. Base Year traffic projections were formulated by applying a defacto growth rate to the existing 2017 traffic count volumes and adding trips generated by known future developments in the vicinity of the Project.

4.1 Defacto Growth Rate

Projections for Base Year 2027 traffic were based upon existing traffic counts performed by ATA, HDOT's Kauai Regional Travel Demand Model (KRTDM) growth for forecast years between 2007 and 2035, and nearby developments in the vicinity of the Project. A 1% annual growth rate was applied to Kuhio Highway, Cane Haul Road and Olohena Road, and a 2% annual growth rate was applied to Kukui Street.

4.2 Traffic Forecasts for Known Developments

By Year 2027, traffic in the Project area is expected to experience significant growth due to several residential and commercial developments in the nearby regions. The majority of trips generated from the known developments are accounted for in the KRTDM growth as described in Section 4.1.

The known developments that are projected to be complete by Year 2027 are illustrated in Figure 4.1 and listed below based on the best information available:

1. Piilani Mai Ke Kai – This project is located in Anahola on the makai side of Kuhio Highway on land owned by the Department of Hawaiian Home Lands (DHHL). The project began in 2006 and includes 181 single-family lots. The majority of the lots have already been awarded and were assumed to be fully occupied at the time of the traffic counts. Of the remaining lots, 22 lots were awarded in January 2017 and an additional 51 lots will be awarded by the end of 2017. Full buildout of the 73 lots is expected by 2027. This development is accounted for in the KRTDM growth rates described in Section 4.1 above.
2. Kulana Subdivision – This project is located north of Olohena Road and east of Hauiki Road. The project is an agricultural subdivision that will contain 172 single-family houses at full buildout. There is currently no expected completion date, however, the project is included in KRTDM forecasts. This development is accounted for in the KRTDM growth rates described in Section 4.1 above.
3. Hokua Place – This project is located between Olohena Road and Kapaa Bypass Road near Kapaa Middle School. The project plans to develop 100 single-family units, 700 multi-family units and 8,000 square feet of neighborhood retail. The project also plans to construct a roadway, Road "A", through the subdivision connecting Kapaa Bypass Road to Olohena Road just west of Kapaa Middle School. Once constructed, the roadway is expected to reduce traffic volumes at the Kapaa Bypass Road/Cane Halu Road/Olohena Road roundabout. The Hokua Place project was previously known as Kapaa Highlands Phase II. The Kapaa Highlands TIAR, dated December 2013, assumes a completion year of 2020. The Kapaa Highlands TIAR was used to determine trips generated and rerouted in the study area.



4. Coconut Plantation – This project is located along the makai side of Kuhio Highway between the Courtyard by Marriott Kauai at Coconut Beach Hotel and the Mokihana Lodge. The project proposes to develop 192 resort units. There is currently no expected completion date, however, for the purposes of this TIAR, the project was assumed to be completed by 2027. A summary of the trips generated may be found in Table 4.1 below.
5. Coconut Beach Resort – This project is located along the makai side of Kuhio Highway between the Courtyard by Marriott Kauai at Coconut Beach Hotel and Kauai Coast Resort at the Beachboy. The project proposes to develop 330 condo units as part of a new beachfront timeshare. Completion is anticipated in 2019. A summary of the trips generated may be found in Table 4.1 below.
6. Coco Palms – This project is located along the mauka side of Kuhio Highway north of Kuamoo Road. The project proposes to restore the old Coco Palms hotel into a 350-room resort. Completion is anticipated by the end of 2018. A summary of the trips generated may be found in Table 4.1 below.

Table 4.1: Background Development Trip Generation

Land Use (ITE Code)	Independent Variable	AM Peak Hour			PM Peak Hour		
		Enter (vph)	Exit (vph)	Total (vph)	Enter (vph)	Exit (vph)	Total (vph)
Coconut Plantation (330)	192 Rooms	26	10	36	35	46	81
Coconut Beach Resort (330)	330 Rooms	66	25	91	60	79	139
Coco Palms (330)	350 Rooms	71	28	99	63	84	147
Total		163	63	226	158	209	367

4.3 Planned Roadway Improvements

Roadway projects that are currently planned and expected to be completed by Year 2027 include:

Kuhio Highway/Mailihuna Road

According to the Final Environmental Impact Statement: Kapaa Stream Bridge & Mailihuna Intersection Improvements, Kuhio Highway (State Route 56), District of Kawaihau, Island of Kauai, “Improvements to the Mailihuna intersection: The existing three-legged intersection on Mailihuna Road, which currently has stop control only, would be reconfigured to improve safety by constructing a roundabout.” The roundabout will provide a 130-foot diameter width roundabout with yield-controls on all approaches. Construction at the intersection is expected to begin in mid-2017 and be completed in 2019. For the purposes of this report, it was assumed that the roundabout alternative will be implemented by Base Year 2027 because it was identified as the preferred alternative.

Several roadway projects to relieve congestion along Kuhio Highway in the Wailua and Kapaa regions are currently in the planning stages. These roadway improvements are not expected to



be completed by Year 2027 and were not included in Base Year 2027 traffic predictions. These roadway projects include:

Kuhio Highway

- Widening Kuhio Highway from the south junction of Kapaa Bypass Road to Kuamoo Road to include an additional southbound lane.
- Widening Kuhio Highway from Kuamoo Road to Kapule Highway to include an additional southbound lane.
- Optimizing traffic signals along Kuhio Highway.

Kapaa Bypass Road

- Extending the Kapaa Bypass Road from Olohena Road to Kuhio Highway by adding a northbound lane.

Additional roadway improvements are recommended in the 2015 Kapaa Transportation Solutions report but are not currently in the planning stages. These roadway improvements are not expected to be completed by Year 2027 and were not included in Base Year 2027 traffic predictions. These roadway projects include:

Other roadway improvements

- Closing the east leg of Kukui Street to allocate more green time to movements on Kuhio Highway.
- Improving the Kuhio Highway/Niu Street intersection to alleviate congestion at the Kuhio Highway/Lehua Street intersection.
- Eliminating the connection from Hauaala Road to Kuhio Highway and creating a new connection from Hauaala Road to Kapaa Bypass Road.

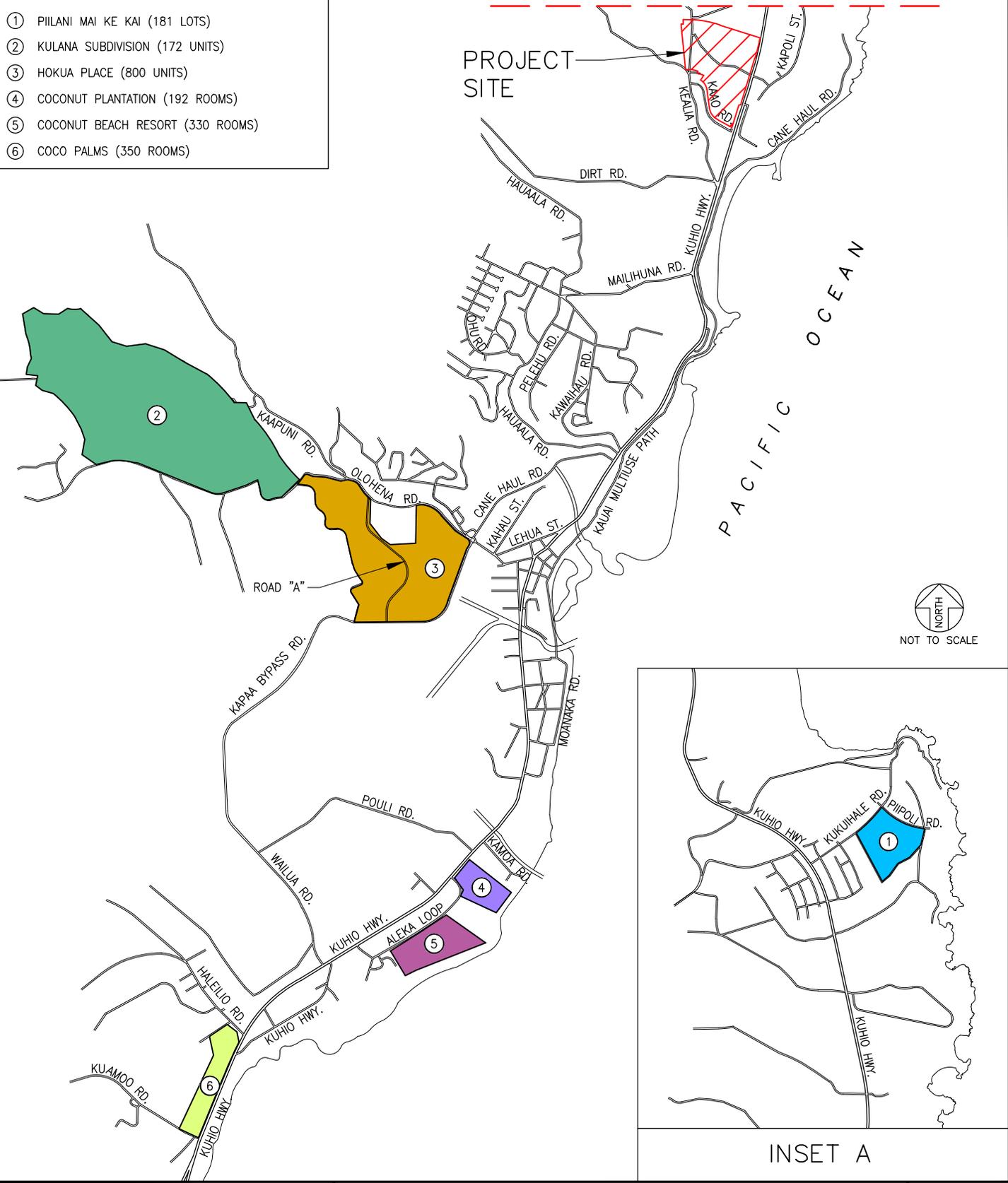
Figure 4.2 shows the location of all planned and proposed roadway improvements in the Project area.

BACKGROUND PROJECTS

- ① PIILANI MAI KE KAI (181 LOTS)
- ② KULANA SUBDIVISION (172 UNITS)
- ③ HOKUA PLACE (800 UNITS)
- ④ COCONUT PLANTATION (192 ROOMS)
- ⑤ COCONUT BEACH RESORT (330 ROOMS)
- ⑥ COCO PALMS (350 ROOMS)

SEE INSET A

PROJECT SITE



KEALIA MAUKA HOMESITES
TIAR

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FIGURE

BACKGROUND DEVELOPMENTS

4.1

**FUNDED PROJECTS
(COMPLETED BY 2027)**

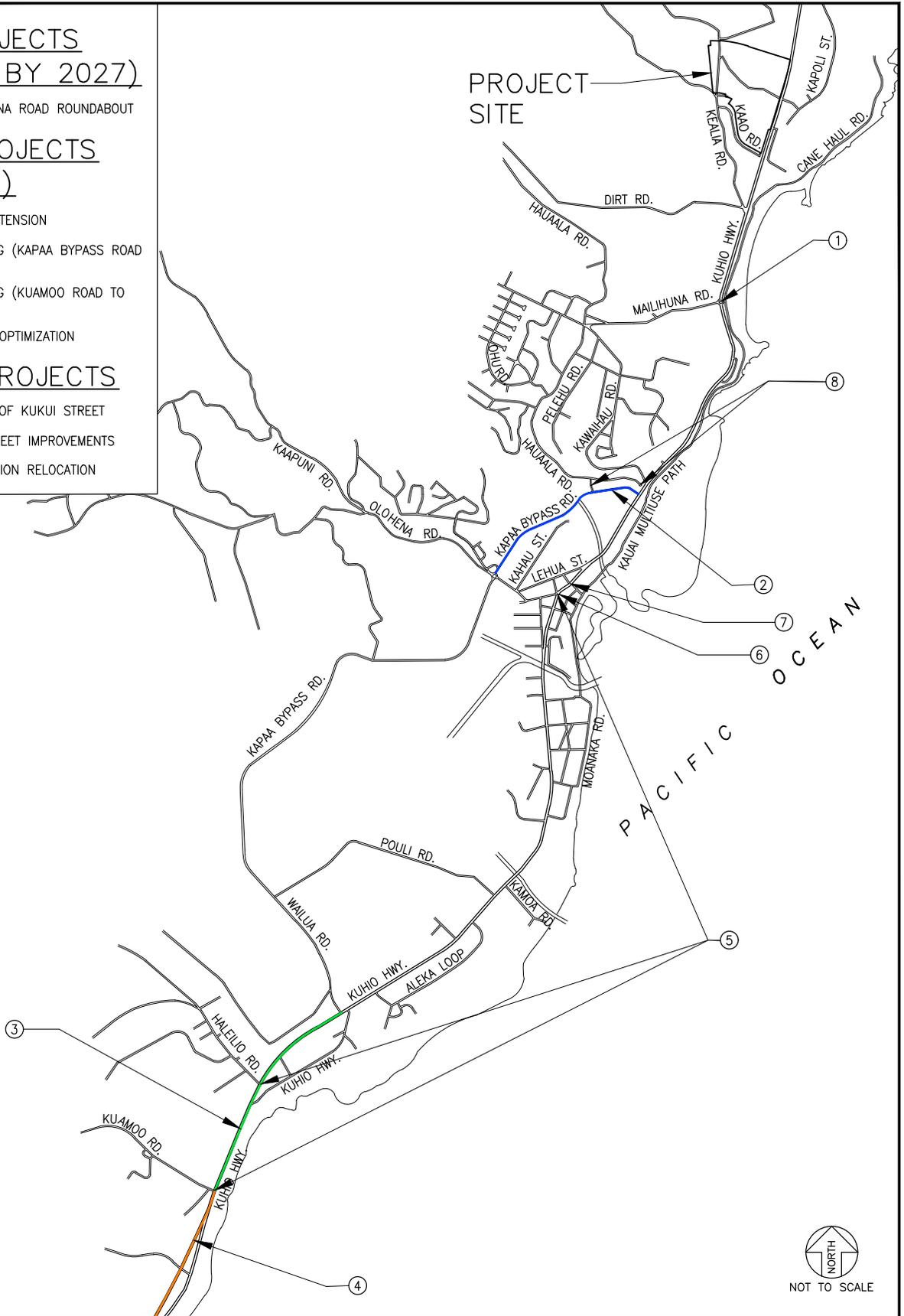
- ① KUHIO HIGHWAY/MAILIHUNA ROAD ROUNDABOUT

**PLANNED PROJECTS
(AFTER 2027)**

- ② KAPAA BYPASS ROAD EXTENSION
- ③ KUHIO HIGHWAY WIDENING (KAPAA BYPASS ROAD TO KUAMOO ROAD)
- ④ KUHIO HIGHWAY WIDENING (KUAMOO ROAD TO KAPULE HIGHWAY)
- ⑤ KUHIO HIGHWAY SIGNAL OPTIMIZATION

PROPOSED PROJECTS

- ⑥ CLOSURE OF EAST LEG OF KUKUI STREET
- ⑦ KUHIO HIGHWAY/NIU STREET IMPROVEMENTS
- ⑧ HAUUALA ROAD CONNECTION RELOCATION



KEALIA MAUKA HOMESITES
TIAR

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ROADWAY IMPROVEMENT PROJECTS

FIGURE

4.2



4.4 Base Year 2027 Analysis

It is anticipated that by Base Year 2027, traffic will have increased by approximately 18%(24%) along Kuhio Highway and by approximately 9%(14%) along Cane Haul Road/Kapaa Bypass Road during the AM(PM) peak hour over existing conditions due to the development in the surrounding regions. Actual growth within the study region may vary based upon the approval process of the various projects.

Peak hour queuing along Kuhio Highway is expected to operate similarly to existing conditions. Although not expected to be completed by Year 2027, the planned widening of Kuhio Highway from Kapaa Bypass Road to Kuamoo Road would reduce queues along Kuhio Highway south of the study intersections. Queuing along Kuhio Highway near Kawaihau Road is expected to remain in Base Year 2027.

Many minor street movements are expected to experience increases in delay due to the increase in traffic along Kuhio Highway. However, the Kuhio Highway/Mailihuna Rd intersection is expected to operate with all movements at LOS C or better with the construction of the planned roundabout. Note that this LOS reflects conditions where drivers are accustomed to the movements through the roundabout. Initial traffic operations at the roundabout may result in longer delays as drivers become familiar with the maneuvers.

The following intersections are expected to continue operating at or worsen to LOS E/F during Base Year 2027 conditions.

[2] Kuhio Highway/Kealia Road

The eastbound approach is expected to operate at LOS E and the westbound approach is expected to operate at LOS F during both peak hours of traffic. Additionally, the westbound approach will operate at overcapacity during the PM peak hour. Because volumes on both approaches are low (≤ 45 vehicles) and adequate gaps in Kuhio Highway traffic were observed, no mitigation is proposed at this intersection.

[4] Kuhio Highway/Kawaihau Road

The eastbound approach is expected to worsen to overcapacity conditions during the AM peak hour. Section 4.5 below discusses two (2) potential scenarios for mitigation at this intersection.

[5] Kuhio Highway/Hauaala Road

The eastbound approach is expected to continue operating at LOS F and overcapacity conditions during the AM peak hour and worsen to LOS F during the PM peak hour. Section 4.5 below discusses two (2) potential scenarios for mitigation at this intersection.

[7] Kuhio Highway/Lehua Street

The eastbound approach is expected to operate at LOS F and overcapacity conditions during both peak hours of traffic. Section 4.5 below discusses two (2) potential scenarios for mitigation at this intersection.



[8] Kuhio Highway/Niu Street

The eastbound approach is expected to worsen to LOS F(E) during the AM(PM) peak hour, and the westbound approach is expected to worsen to LOS E during the AM peak hour. Because adequate gaps in traffic were observed due to the intersection's proximity to the Kukui Street signal, the minor street movements are expected to continue operating adequately, and no mitigation is proposed.

[9] Kuhio Highway/Kukui Street

During both peak hours of traffic, the northbound shared through/right-turn movement is expected to operate at overcapacity due to the increase in traffic along Kuhio Highway. The minor street movements are expected to continue operating at LOS F(E) during the AM(PM) peak hour because of the long coordinated cycle length. Because the minor street movements operate at under capacity conditions, no mitigation is proposed for the minor movements. Section 4.5 below discusses two (2) potential scenarios for mitigation at this intersection for the Kuhio Highway northbound movement.

[10] Kapaa Bypass Road/Cane Haul Road/Olohena Road

Operations at this intersection are anticipated to improve over existing conditions due to the proposed Road "A" through the Hokuia Place development. With a portion of traffic expected to utilize Road "A" over traveling through the Kapaa Bypass Road/Cane Haul Road/Olohena Road roundabout, all approaches of the roundabout are anticipated to operate at LOS C or better during both peak hours of traffic.

Figure 4.3 illustrates the Base Year 2027 forecast traffic volumes and LOS for the study intersection movements. Table 4.2 summarizes the Base Year 2027 LOS at the study intersections compared to existing conditions. LOS worksheets are provided in Appendix C.

4.5 Base Year 2027 With Mitigation Analysis

In order to improve Base Year 2027 traffic operations at the study intersections, the Kapaa Bypass Road extension and the relocation of the Hauaala Road connection, as described in Section 4.3, are the preferred mitigations. Although the Kapaa Bypass Road extension is currently planned by HDOT, the project is not expected to be completed by Year 2027. In the event that the bypass extension is completed by Year 2027, Base Year 2027 with Mitigation traffic operations are projected as described in Section 4.5.1 below. If the bypass extension is not completed, alternative mitigations are proposed as described in Section 4.5.2 below.

4.5.1 Base Year 2027 With Mitigation With Kapaa Bypass Road Extension

Kapaa Bypass Road Extension

The Kapaa Bypass Road extension from Olohena Road to Kuhio Highway would add a northbound lane to the existing one-way Cane Haul Road. With the extension, vehicles will be able to head farther north on the bypass road, and the left-turns from Lehua Street onto Kuhio Highway are expected to decrease. The extension has been identified as a proposed roadway improvement in the 2015 Kapaa Transportation Solutions report and has been acknowledged as a planned improvement by HDOT. With the extension, improvements will also be completed at the northern terminus. However, these improvements are currently not identified.



Hauaala Road Connection

With the Kapaa Bypass Road extension, the existing Hauaala Road connection to Kuhio Highway can be eliminated and replaced with a new connection from Hauaala Road to the Kapaa Bypass Road. Moving the Hauaala Road connection is expected to relieve congestion in the vicinity of the existing Kuhio Highway/Hauaala Road intersection by reducing the number of conflicting turning movements and providing a longer northbound left-turn pocket at the nearby Kuhio Highway/Kawaihau Road intersection. It was assumed that the proposed Kapaa Bypass Road/Hauaala Road intersection will have a stop-controlled left-/right-turn movement on Hauaala Road and shared eastbound left-turn/through and westbound through/right-turn movements on Kapaa Bypass Road. Relocating the Hauaala Road connection has been identified as a proposed roadway improvement in the 2015 Kapaa Transportation Solutions report.

With the above mitigations, operations at several intersections are expected to improve due to changes in traffic patterns. The following changes in intersection operations are expected.

[3] Kuhio Highway/Mailihuna Road

Although operations at this intersection are not expected to improve with the proposed mitigation, a portion of traffic heading northbound on Kapaa Bypass Road is expected to access Kuhio Highway from this intersection via the proposed Hauaala Road connection. No changes in LOS are anticipated at this intersection.

[4] Kuhio Highway/Kawaihau Road

With the proposed mitigation, a portion of vehicles currently turning onto Kawaihau Road from Kuhio Highway and from Kawaihau Road onto the highway are expected to use the Kapaa Bypass Road and Hauaala Road to access residential areas. Although LOS on the eastbound approach is expected to remain the same at LOS F(D) during the AM(PM) peak hour, the approach is anticipated to operate under capacity with the improvements. The intersection is expected to continue to self-regulate during congested periods.

[5] Kuhio Highway/Hauaala Road

With the proposed mitigation, the Kuhio Highway/Hauaala Road intersection will be replaced with the Kapaa Bypass Road/Hauaala Road intersection. The new Hauaala Road approach is expected to operate under capacity at LOS E(C) during the AM(PM) peak hour of traffic.

[6] Kuhio Highway/Cane Haul Road

With the proposed mitigation, Cane Haul Road will become the two-way Kapaa Bypass Road. Existing intersection configuration is assumed to remain with the addition of a new stop-controlled eastbound left-/right-turn lane. The eastbound approach is expected to operate at LOS F(E) during the AM(PM) peak hour of traffic due to the high volumes along Kuhio Highway. However, with the elimination of the Kuhio Highway/Hauaala Road intersection, the existing left-turn lane can be turned into a refuge lane to reduce conflicts for the left-turn from Kapaa Bypass Road. Additional improvements at this intersection may be completed with the Kapaa Bypass Road extension but are not currently identified and were therefore not included in the Base Year 2027 analysis.



[7] Kuhio Highway/Lehua Street

With the proposed mitigation, the eastbound left-turn volume from Lehua Street onto Kuhio Highway is expected to decrease as vehicles will be able to travel farther north on the Kapaa Bypass Road. The eastbound approach is expected to operate at LOS E during both peak hours of traffic.

[8] Kuhio Highway/Niu Street

With the proposed mitigation, a portion of vehicles currently using Kuhio Highway is expected to utilize the Kapaa Bypass Road instead. As a result, the minor street movements at this intersection are expected to experience a slight decrease in delay.

[9] Kuhio Highway/Kukui Street

With the proposed mitigation, a portion of vehicles currently using Kuhio Highway is expected to utilize the Kapaa Bypass Road instead. Additionally, with the decrease in congestion near the existing Kuhio Highway/Kawaihau Road and Kuhio Highway/Hauaala Road intersections, queuing along Kuhio Highway is expected to decrease and improve through progression at this intersection.

[10] Kapaa Bypass Road/Cane Haul Road/Olohena Road

With the proposed mitigation, the Kapaa Bypass Road/Cane Haul Road/Olohena Road roundabout is expected to experience a significant increase in volume. With the northbound extension of the bypass road and new Hauaala Road connection, a larger portion of traffic will be diverted to Kapaa Bypass Road from Kuhio Highway. Due to the increase in volume, the eastbound approach is expected to operate at LOS E during the AM peak hour of traffic similar to existing conditions.

Figure 4.4 illustrates the Base Year 2027 with mitigation, including the Kapaa Bypass Road extension, forecast traffic volumes and LOS for the study intersection movements. Table 4.2 summarizes the Base Year 2027 with the bypass extension LOS at the study intersections compared to Base Year 2027 without mitigation and existing conditions. LOS worksheets are provided in Appendix C.

4.5.2 Base Year 2027 With Mitigation Without Kapaa Bypass Road Extension

The Federal Highway Administration (FHWA) Manual on Uniform Traffic Control Devices (MUTCD) 2009 Edition was used to determine if a traffic signal would be warranted at intersections with movements operating at overcapacity conditions. Based on existing traffic volumes, Warrant 2, Four-Hour Vehicular Volume signal warrant is met¹ at the Kuhio Highway/Lehua Street intersection. However, a signal at Kuhio Highway/Lehua Street may not yield any significant benefits because of existing northbound queues along Kuhio Highway and because vehicles currently allow major street left-turns and minor street movements to proceed during congested periods and adequate gaps in traffic were observed during non-peak hours.

¹ Note that a full signal warrant study was not performed and only available data was used to determine if a signal would be warranted.



Other improvements mentioned in Section 4.3 from the Kapaa Transportation Solutions report may be more appropriate:

- Closing the east leg of Kukui Street to allocate more green time to movements on Kuhio Highway.
- Improving the Kuhio Highway/Niu Street intersection to alleviate congestion at the Kuhio Highway/Lehua Street intersection.

Although not specified in the Kapaa Transportation Solutions report, improving the Kuhio Highway/Niu Street intersection likely consists of providing, similar to the Lehua Street intersection, a northbound refuge lane for eastbound left-turns.

By year 2027 signals may be warranted at the intersections of Kuhio Highway with Kawaihau Road and Hauaala Road. Analysis of traffic signals at these intersections would not provide accurate results as the analysis doesn't take into account the close proximity of the intersections. Based on observations, with a traffic signal, queues are expected to lengthen in the northbound direction due to the delays caused by the signal, the short northbound storage length and the fact that vehicles along Kuhio Highway would be less likely to yield to the minor movements when a signal is installed. Currently, without a signal, vehicles in the southbound through yield to the eastbound approach at a rate of approximately one (1) to two (2) eastbound vehicles to four (4) southbound through; therefore, it is anticipated that this type of behavior would continue. Furthermore, improvements at the Kuhio Highway/Mailihuna Road intersection may provide some relief at the Kawaihau Road and Hauaala Road intersections. Additionally, community input may be a factor in determining the viability of the improvement.

With the above mitigations, the following changes in intersection operations are expected.

[3-5] Kuhio Highway from Mailihuna Road to Hauaala Road

Although these intersections will not be affected by the proposed mitigation, it is anticipated that if the new Hauaala Road connection to Kapaa Bypass Road is not constructed, vehicles will likely modify their travel routes to those with more favorable travel times. Because Mailihuna Road, Kawaihau Road and Hauaala Road all provide access to an interconnected roadway network serving residential areas, it is anticipated that a portion of vehicles will change the roadway they use to access Kuhio Highway.

[7] Kuhio Highway/Lehua Street

With the proposed mitigation, a portion of vehicles currently accessing Kuhio Highway via the Kuhio Highway/Lehua Street intersection are expected to access the highway at either Kuhio Highway/Niu Street or Kuhio Highway/Kukui Street in order to minimize delays. Although the eastbound approach will continue to operate at LOS F during both peak hours of traffic, the movement will operate at under capacity with lower delays than Base Year 2027 without mitigation.

[8] Kuhio Highway/Niu Street

With the proposed mitigation, vehicles will have an easier time making an eastbound left-turn from Niu Street onto Kuhio Highway, and a portion of vehicles will be diverted to this intersection from the Kuhio Highway/Lehua Street intersection. Because larger volumes are expected to utilize this intersection, the eastbound approach is expected to operate at LOS F during both



peak hours of traffic and the westbound approach is expected to operate at LOS E during both peak hours. However, all movements are expected to operate at under capacity, and turning movements will likely benefit from the proximity of the Kukui Street signal.

[9] Kuhio Highway/Kukui Street

With the longer delays projected at the Kuhio Highway/Lehua Street intersection, vehicles are expected to utilize the Kuhio Highway/Kukui Street intersection as an alternative route. Because of the larger volume expected at this intersection, the eastbound left-turn movement is expected to continue operating at LOS F during the AM peak hour and worsen from LOS E to LOS F during the PM peak hour. However, the eastbound movement will continue to operate under capacity with delay caused by the long cycle length favoring Kuhio Highway. Despite long green times allotted to Kuhio Highway, the northbound through/right-turn movement will continue to operate at overcapacity conditions.

Figure 4.5 illustrates the Base Year 2027 with mitigation, without the Kapaa Bypass Road extension, forecast traffic volumes and LOS for the study intersection movements. Table 4.2 summarizes the Base Year 2027 mitigation without the bypass extension LOS at the study intersections compared to Base Year 2027 without mitigation and existing conditions. LOS worksheets are provided in Appendix C.



NOT TO SCALE

NOTE:
THIS DRAWING IS FOR ILLUSTRATIVE PURPOSES ONLY. DO NOT USE FOR CONSTRUCTION.

LEGEND

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

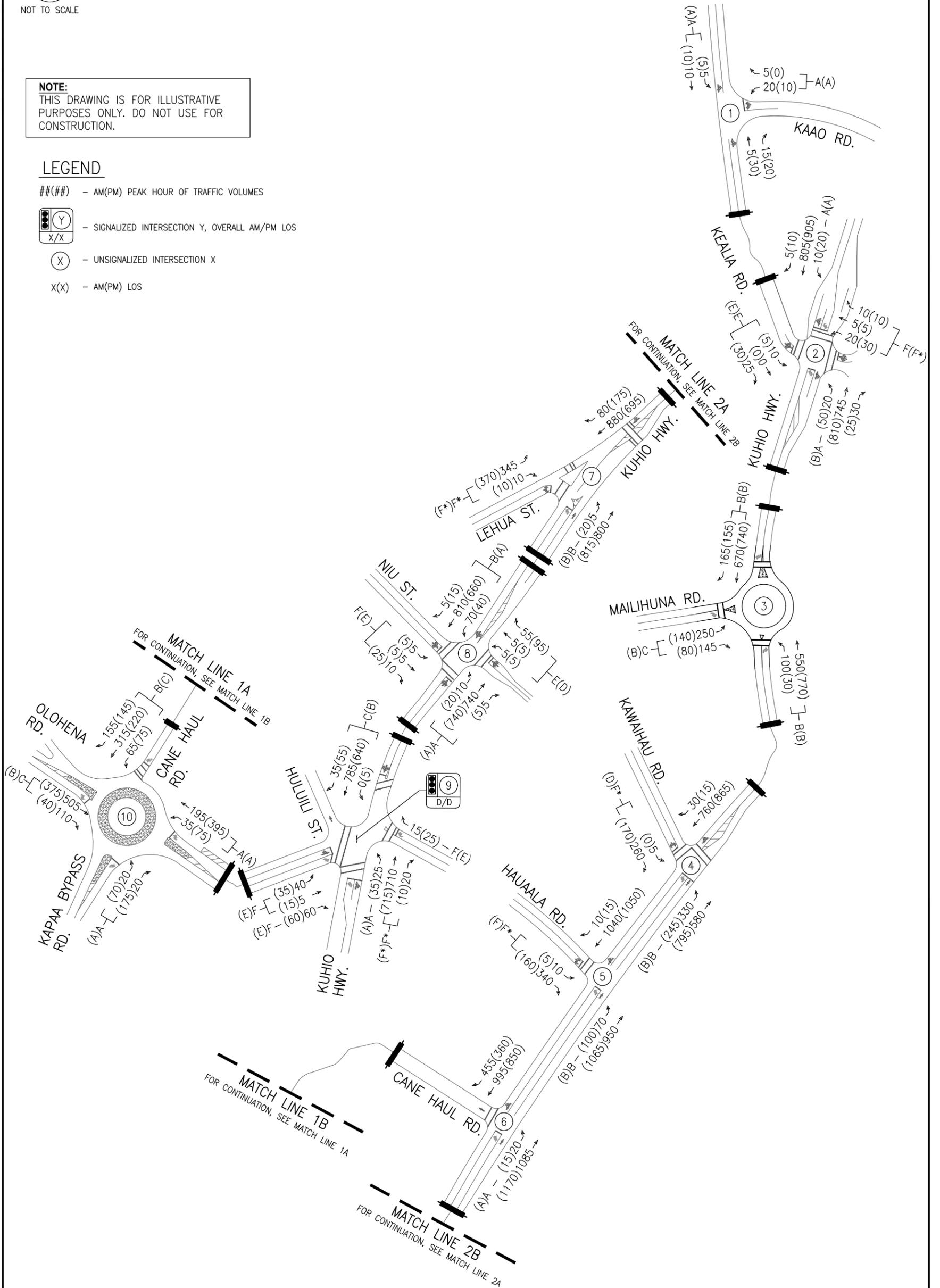


- SIGNALIZED INTERSECTION Y, OVERALL AM/PM LOS



- UNSIGNALIZED INTERSECTION X

X(X) - AM(PM) LOS



KEALIA MAUKA HOMESITES TIAR

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

**BASE YEAR 2027 LANE CONFIGURATION,
VOLUMES AND MOVEMENT LOS**

FIGURE

4.3



NOT TO SCALE

NOTE:
THIS DRAWING IS FOR ILLUSTRATIVE PURPOSES ONLY. DO NOT USE FOR CONSTRUCTION.

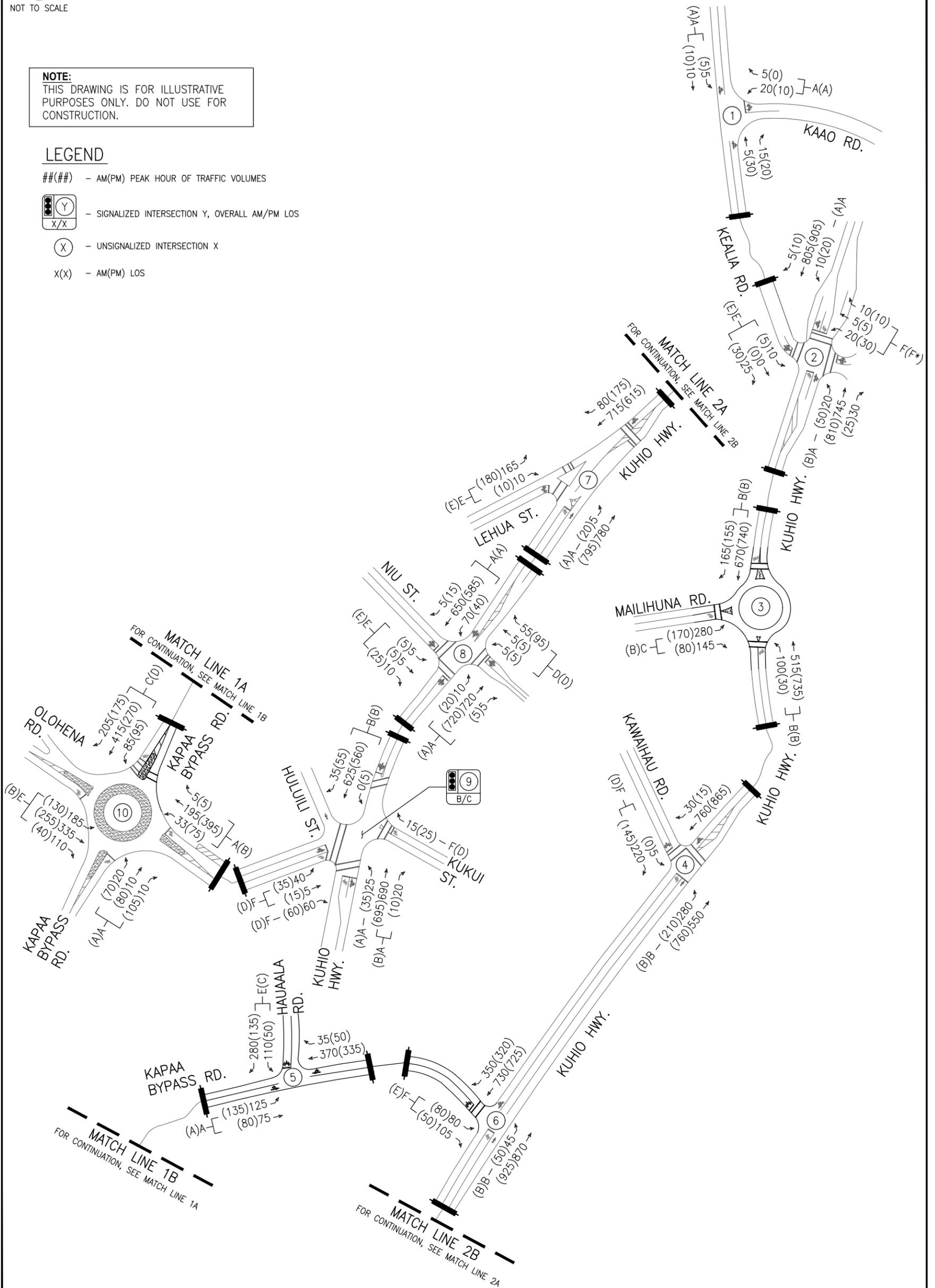
LEGEND

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

 - SIGNALIZED INTERSECTION Y, OVERALL AM/PM LOS

 - UNSIGNALIZED INTERSECTION X

X(X) - AM(PM) LOS



KEALIA MAUKA HOMESITES TIARA

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

BASE YEAR 2027 WITH MITIGATION LANE CONFIGURATION, VOLUMES AND MOVEMENT LOS (WITH KAPAA BYPASS ROAD EXTENSION)

FIGURE

4.4



NOT TO SCALE

NOTE:
THIS DRAWING IS FOR ILLUSTRATIVE PURPOSES ONLY. DO NOT USE FOR CONSTRUCTION.

LEGEND

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

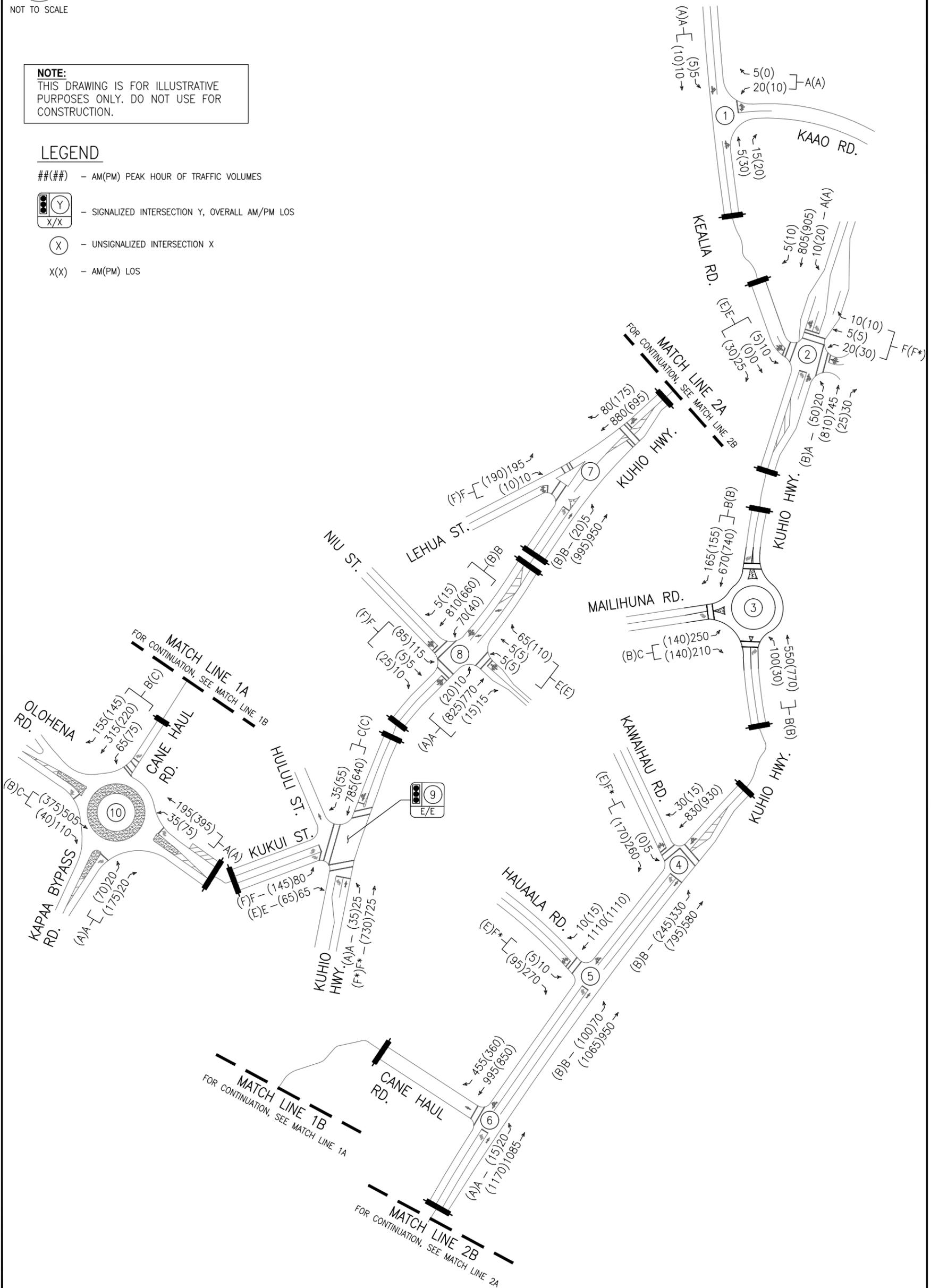


- SIGNALIZED INTERSECTION Y, OVERALL AM/PM LOS



- UNSIGNALIZED INTERSECTION X

X(X) - AM(PM) LOS



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ENGINEERS, SURVEYORS HONOLULU, HAWAII

BASE YEAR 2027 WITH MITIGATION LANE CONFIGURATION, VOLUMES AND MOVEMENT LOS (WITHOUT KAPAA BYPASS ROAD EXTENSION)

FIGURE

4.5

Table 4.2: Existing Conditions, Base Year 2027 and Base Year 2027 with Mitigation Level of Service Summary

Intersection	Existing Conditions						Base Year 2027						Base Year 2027 with Mitigation (With Kapaa Bypass Extension)						Base Year 2027 with Mitigation (Without Kapaa Bypass Extension)					
	AM			PM			AM			PM			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	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS
1: Kealia Rd & Kaao Rd																								
WB LT/RT	8.7	0.02	A	8.8	0.01	A	8.7	0.03	A	8.9	0.01	A	Same as Base Year 2027						Same as Base Year 2027					
SB LT/TH	7.3	0.00	A	7.3	0.00	A	7.3	0.00	A	7.3	0.00	A												
Overall	4.1	-	-	1.4	-	-	4.2	-	-	1.7	-	-												
2: Kuhio Hwy & Kealia Rd																								
NB LT	9.2	0.03	A	9.6	0.06	A	9.8	0.03	A	10.6	0.08	B	Same as Base Year 2027						Same as Base Year 2027					
EB LT/TH/RT	24.0	0.16	C	19.8	0.12	C	39.7	0.27	E	40.4	0.27	E												
WB LT/TH/RT	47.2	0.26	E	76.6	0.44	F	88.9	0.49	F	315.8	1.11	F*												
SB LT	9.1	0.01	A	9.1	0.02	A	9.6	0.01	A	9.9	0.03	A												
Overall	1.7	-	-	2.5	-	-	2.8	-	-	8.6	-	-												
3: Kuhio Hwy & Mailihuna Rd																								
NB LT/TH	9.8	0.12	A	9.5	0.04	A	12.8	0.66	B	13.7	0.72	B	12.7	0.64	B	13.8	0.71	B	12.8	0.66	B	13.7	0.72	B
EB LT/RT	447.4	1.85	F*	107.4	0.97	F	17.1	0.63	C	11.1	0.38	B	19.2	0.68	C	12.2	0.43	B	22.3	0.74	C	13.4	0.48	B
SB TH/RT	-	-	-	-	-	-	13.3	0.72	B	12.4	0.71	B	13.3	0.72	B	12.4	0.71	B	13.3	0.72	B	12.4	0.71	B
Overall	89.9	-	-	12.3	-	-	13.9	-	B	12.8	-	B	14.4	-	B	12.9	-	B	15.3	-	C	13.1	-	B
4: Kuhio Hwy & Kawaihau Rd																								
NB LT	11.2	0.38	B	10.9	0.30	B	13.7	0.47	B	13.1	0.38	B	12.7	0.40	B	12.5	0.32	B	14.8	0.50	B	13.9	0.40	B
EB LT/RT	77.0	0.98	F	24.1	0.56	C	92.5	1.00	F*	32.2	0.59	D	54.8	0.82	F	27.9	0.51	D	134.5	1.12	F*	38.8	0.65	E
Overall	16.9	-	-	4.5	-	-	14.8	-	-	4.2	-	-	8.6	-	-	3.3	-	-	19.9	-	-	4.7	-	-
5: Kuhio Hwy & Hauaala Rd***																								
NB LT	10.6	0.10	B	10.9	0.15	B	11.8	0.13	B	12.4	0.18	B	-	-	-	-	-	-	12.3	0.13	B	13.0	0.19	B
EB LT/TH	-	-	-	-	-	-	-	-	-	-	-	-	8.7	0.12	A	8.6	0.13	A	-	-	-	-	-	-
EB LT/RT	213.2	1.35	F*	32.5	0.58	D	381.0	1.72	F*	94.7	0.92	F	-	-	-	-	-	-	323.2	1.57	F*	67.0	0.69	F
SB LT/RT	-	-	-	-	-	-	-	-	-	-	-	-	41.7	0.86	E	16.6	0.39	C	-	-	-	-	-	-
Overall	36.2	-	-	3.8	-	-	56.0	-	-	8.2	-	-	17.4	-	-	5.4	-	-	38.4	-	-	4.7	-	-
6: Kuhio Hwy & Cane Haul Rd**																								
NB LT	-	-	-	-	-	-	-	-	-	-	-	-	11.6	0.08	B	11.4	0.09	B	Same as Base Year 2027					
NB LT/TH	1.1	0.04	A	0.7	0.02	A	1.7	0.05	A	0.9	0.03	A	-	-	-	-	-	-						
EB LT/RT	-	-	-	-	-	-	-	-	-	-	-	-	58.0	0.80	F	42.1	0.61	E						
Overall	0.2	0.72	C	0.1	0.58	B	0.3	0.84	E	0.2	0.70	C	5.2	-	-	2.8	-	-						
7: Kuhio Hwy & Lehua St																								
NB LT	9.8	0.01	A	9.5	0.02	A	10.5	0.01	B	10.2	0.03	B	9.7	0.01	A	9.8	0.03	A	10.5	0.01	B	10.2	0.03	B
EB LT/RT	98.3	1.03	F*	87.1	1.01	F*	273.1	1.48	F*	295.6	1.54	F*	35.9	0.64	E	44.1	0.72	E	89.2	0.94	F	89.6	0.94	F
Overall	16.1	-	-	15.7	-	-	45.8	-	-	54.0	-	-	3.6	-	-	4.8	-	-	8.7	-	-	8.7	-	-
8: Kuhio Hwy & Niu St																								
NB LT/TH/RT	9.3	0.01	A	9.0	0.02	A	9.9	0.02	A	9.5	0.03	A	9.2	0.01	A	9.2	0.03	A	9.9	0.02	A	9.5	0.03	A
EB LT/TH/RT	45.9	0.14	E	16.9	0.08	C	74.0	0.30	F	43.4	0.29	E	49.6	0.21	E	35.4	0.24	E	119.7	0.95	F	128.8	0.95	F
WB LT/TH/RT	22.7	0.25	C	20.7	0.33	C	38.5	0.40	E	33.5	0.48	D	29.6	0.33	D	29.6	0.44	D	40.6	0.45	E	44.2	0.60	E
SB LT/TH/RT	9.5	0.09	A	9.3	0.05	A	10.0	0.10	B	10.0	0.06	A	9.9	0.09	A	9.9	0.06	A	10.2	0.10	B	10.5	0.06	B
Overall	1.9	-	-	2.3	-	-	2.8	-	-	3.5	-	-	2.4	-	-	3.2	-	-	10.3	-	-	11.4	-	-

Table 4.2: Existing Conditions, Base Year 2027 and Base Year 2027 with Mitigation Level of Service Summary Cont'd

Intersection	Existing Conditions						Base Year 2027						Base Year 2027 with Mitigation (With Kapaa Bypass Extension)						Base Year 2027 with Mitigation (Without Kapaa Bypass Extension)																																			
	AM			PM			AM			PM			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	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS																														
9: Kuhio Hwy & Kukui St**																																																						
NB LT	2.2	0.04	A	3.5	0.06	A	3.6	0.05	A	2.7	0.06	A	2.3	0.04	A	3.7	0.07	A	4.3	0.06	A	4.7	0.07	A																														
NB TH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	86.8	1.13	F*	83.3	1.11	F*																														
NB TH/RT	33.2	0.96	C	35.6	0.95	D	79.2	1.11	F*	74.5	1.09	F*	8.2	0.74	A	16.5	0.83	B	-	-	-	-	-	-																														
EB LT	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	87.7	0.62	F	112.1	0.87	F																														
EB LT/TH	95.5	0.32	F	44.9	0.15	D	96.1	0.41	F	75.3	0.29	E	96.1	0.41	F	45.6	0.22	D	-	-	-	-	-	-																														
EB RT	92.3	0.03	F	43.9	0.03	D	91.6	0.04	F	72.5	0.04	E	91.6	0.04	F	44.1	0.05	D	76.3	0.05	E	70.8	0.06	E																														
WB RT	92.0	0.01	F	43.8	0.02	D	91.3	0.01	F	72.3	0.02	E	91.3	0.01	F	43.9	0.02	D	-	-	-	-	-	-																														
SB TH/RT	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	27.5	0.93	C	20.5	0.83	C																														
SB LT/TH/RT	10.7	0.75	B	16.2	0.75	B	21.9	0.89	C	18.6	0.82	B	10.5	0.72	B	19.9	0.81	B	-	-	-	-	-	-																														
Overall	25.8	-	C	26.9	-	C	51.3	-	D	48.3	-	D	15.8	-	B	20.2	-	C	56.9	-	E	57.5	-	E																														
10: Kapaa Bypass Rd/Cane Haul Rd & Olohena Rd																																																						
NB LT/TH/RT	-	-	-	-	-	-	-	-	-	-	-	-	5.9	0.06	A	8.8	0.35	A	Same as Base Year 2027																																			
NB LT/RT	6.5	0.10	A	10.5	0.43	B	5.6	0.06	A	8.2	0.33	A	-	-	-	-	-	-							Same as Base Year 2027																													
EB TH/RT	46.5	0.95	E	13.2	0.55	B	22.1	0.79	C	10.7	0.51	B	-	-	-	-	-	-													Same as Base Year 2027																							
EB LT/TH/RT	-	-	-	-	-	-	-	-	-	-	-	-	40.9	0.93	E	12.6	0.56	B																			Same as Base Year 2027																	
WB LT/TH	5.1	0.18	A	8.4	0.41	A	4.3	0.19	A	6.9	0.41	A	-	-	-	-	-	-																									Same as Base Year 2027											
WB LT/TH/RT	-	-	-	-	-	-	-	-	-	-	-	-	5.7	0.24	A	10.2	0.52	B																															Same as Base Year 2027					
SB LT/TH/RT	13.7	0.62	B	19.0	0.66	C	10.9	0.57	B	16.9	0.65	C	17.1	0.75	C	25.4	0.80	D																																				
Overall	27.6	-	D	13.0	-	B	14.6	-	B	10.9	-	B	24.5	-	C	15.5	-	C	Same as Base Year 2027																																			

* Denotes overcapacity condition, v/c ≥ 1.

** Intersection analyzed using HCM 2000 methodology due to HCM 6th Edition methodology currently not supporting signalized intersections with a stop-controlled, right-turn only approach or unsignalized intersections without at least one stop-controlled approach.

*** Values for intersection 5: Kuhio Hwy & Hauaala Rd represent the Kapaa Bypass Road/Hauaala Road intersection for Base Year 2020 with Mitigation.



5. FUTURE YEAR 2027

5.1 Background

The Project proposes to develop 235 single-family dwellings in the Kealia area. Access to the Project will be provided via Kealia Road from Kuhio Highway. The Project will construct a new four-way, one-lane roundabout north of the Kealia Road/Hopoe Road intersection to connect Kealia Road to the Project site. Both the southern and western approaches of the roundabout will have connections to Kealia Road. Although there is currently a direct access to Kuhio Highway along the Makai side of the Project site, this access will be fully removed during Project construction. Construction and occupancy of homes in the proposed subdivision is anticipated in 2027.

5.2 Travel Demand Estimations

The HDOT and Kauai County provide various Transportation Demand Management (TDM) programs that promote the use of transit, walking, biking and alternative modes of transportation to reduce the use of single-occupant vehicles on roadways. These TDM measures have only been identified and conservatively assumed to yield no vehicular reductions for Project generated traffic.

5.2.1 Trip Generation

The Institute of Transportation Engineers (ITE) publishes a book based on empirical data compiled from a body of more than 4,250 trip generation studies submitted by public agencies, developers, consulting firms, and associations. This publication, titled Trip Generation Manual, 10th Edition, provides trip rates and/or formulae based on graphs that correlate vehicular trips with independent variables. The independent variables can range from Dwelling Units (DU) for single-family attached homes to Gross Floor Area (GFA) for commercial or office development. These trip rates/formulae and their associated directional distributions were used to estimate the increase in the number of vehicular trips generated by the proposed Project. The rates selected were based on the land use description.

See Tables 5.1 and 5.2 for Trip Generation formulae and projections for the Project.

Table 5.1: Trip Generation Rates

Land Use	Independent Variable	AM Peak Hour		PM Peak Hour	
		Trip Rate	% Enter	Trip Rate	% Enter
Single-Family Detached Housing (210)	Dwelling Units (DU)	[a]	25%	[b]	63%

[a] $T = 0.7X + 4.80$

[b] $LN(T) = 0.96LN(X) + 0.2$



Table 5.2: Project-Generated Trips

Land Use	Independent Variable	AM Peak Hour			PM Peak Hour		
		Enter (vph)	Exit (vph)	Total (vph)	Enter (vph)	Exit (vph)	Total (vph)
Single-Family Detached Housing (210)	235 DU	43	129	172	146	85	231

5.2.2 Trip Distribution and Assignment

Trips generated by the Project were assigned throughout the study area generally based upon existing travel patterns. The traffic generated by the Project was added to the forecast Base Year 2027 traffic volumes to constitute the traffic volumes for Future Year 2027 traffic conditions. Project trips utilizing Kapaa Bypass Road were distributed differently for the scenarios with and without the bypass road extension completion by Year 2027. It was assumed that with the bypass extension and new Hauaala Road connection, volumes along the bypass road would be higher and fewer Project trips would utilize the roadway. However, without the bypass extension and new connection, it was assumed that the bypass would continue to be less congested than Kuhio Highway, and Project trips would favor utilizing the bypass road. Figures 5.1 and 5.4 illustrate the Project-generated trip distributions with and without the bypass road extension, respectively.

5.3 Future Year 2027 Analysis

At full buildout, the Project is projected to generate a total of 172(231) net external trips during the AM(PM) peak hour of traffic. Traffic from the Project is expected to generate growth along major roadways in the study area.

5.3.1 Future Year 2027 With Kapaa Bypass Road Extension

Similar to Base Year 2027, queuing along Kuhio Highway is expected to remain south of the study intersections until the widening of the roadway is completed. However, with Base Year 2027 mitigations, a decrease in queuing is expected in Kapaa town with the extension of the Kapaa Bypass Road and relocation of the Hauaala Road connection. Although queuing is expected to remain due to the high volume of turning movements in the area, queues will likely be reduced due to the diversion of traffic to Kapaa Bypass Road.

The majority of study intersections are forecast to experience increases in delay over Base Year 2027. Intersection movements currently operating at LOS E/F conditions will continue to operate at LOS E/F conditions in Future Year 2027. Below is a description of the intersections with movements that are projected to continue operating at or worsen to LOS E/F during the AM and/or PM peak hours of traffic.

[2] Kuhio Highway/Kealia Road

Because Kuhio Highway/Kealia Road is the only access point to the Project from Kuhio Highway, the intersection is expected to experience a significant increase in traffic. During both peak hours of traffic, the eastbound approach is expected to worsen to LOS F and overcapacity



conditions. The westbound approach is also expected to operate at overcapacity conditions during the PM peak hour. Mitigation is proposed in Section 5.4 below.

[4] Kuhio Highway/Kawaihau Road

The eastbound approach is expected to continue operating at LOS F during the AM peak hour. However, the intersection is expected to self-regulate as in existing conditions to reduce delay to the eastbound approach. Because of a lack of feasible alternatives, no mitigation is proposed for this intersection.

[5] Kapaa Bypass Road/Hauaala Road

The southbound approach is expected to continue operating at LOS E during the AM peak hour. Because the approach will continue to operate under capacity as in Base Year 2027 with mitigation conditions, no mitigation is proposed for this intersection.

[6] Kuhio Highway/Kapaa Bypass Road

The eastbound approach is expected to continue operating at or worsen to LOS F during both peak hours of traffic. Although the eastbound approach is expected to experience delays over Base Year 2027 conditions, the proposed refuge lane is anticipated to help minimize delays to the eastbound left-turn movement. Additionally, the approach will continue to operate under capacity, and no mitigation is proposed at this intersection.

[7] Kuhio Highway/Lehua Street

The eastbound approach is expected to continue operating at LOS E during the AM peak hour and worsen to LOS F during the PM peak hour. However, the intersection is expected to self-regulate as in existing conditions to reduce delay to the eastbound approach. All movements will continue to operate under capacity, and no mitigation is proposed at this intersection.

[8] Kuhio Highway/Niu Street

The eastbound approach is expected to worsen to LOS F during the AM peak hour and continue operating at LOS E during the PM peak hour. As in Base Year 2027 conditions, adequate gaps in traffic are expected due the intersection's proximity to the Kukui Street signal and the minor street movements are expected to continue operating adequately. No mitigation is proposed at this intersection.

[9] Kuhio Highway/Kukui Street

Both minor street approaches are expected to continue operating at LOS F during the AM peak hour of traffic due to a longer green time being allotted to the Kuhio Highway through movements. Because the minor streets will continue to operate under capacity, no mitigation is proposed for this intersection.

Figure 5.2 illustrates the Future Year 2027 forecast traffic volumes and LOS for the study intersection movements. Table 5.3 summarizes the Future Year 2027 LOS at the study intersections compared to Base Year 2027 with mitigation conditions. Both Figure 5.2 and Table 5.3 reflect conditions with the Kapaa Bypass Road extension completed by Year 2027. LOS worksheets are provided in Appendix C.



5.3.2 Future Year 2027 Without Kapaa Bypass Road Extension

Similar to Base Year 2027, queuing along Kuhio Highway within and south of the Project area is expected to remain until congestion relief projects are completed in Kapaa and Wailua. In the Project area, while major through movements are expected to continue allowing other movements to proceed during congested periods to reduce major left-turn and minor movement delay, all movements are expected to experience longer delays over existing conditions.

The majority of study intersections are forecast to experience increases in delay over Base Year 2027. Intersection movements currently operating at LOS E/F conditions will continue to operate at LOS E/F conditions in Future Year 2027. Below is a description of the intersections with movements that are projected to continue operating at or worsen to LOS E/F during the AM and/or PM peak hours of traffic.

[2] Kuhio Highway/Kealia Road

Because Kuhio Highway/Kealia Road is the only access point to the Project from Kuhio Highway, the intersection is expected to experience a significant increase in traffic. During both peak hours of traffic, the eastbound approach is expected to worsen to LOS F and overcapacity conditions. The westbound approach is also expected to operate at overcapacity conditions during the PM peak hour. Mitigation is proposed in Section 5.4 below.

[4] Kuhio Highway/Kawaihau Road

The eastbound approach is expected to continue operating at LOS F and overcapacity during the AM peak hour and LOS E during the PM peak hour. Similar to Base Year 2027, although a signal may be warranted at this intersection, it may create longer delays. However, the intersection is expected to self-regulate as in existing conditions to reduce delay to the eastbound approach. Additionally, a larger portion of vehicles may use Mailihuna Road to access Kuhio Highway due to the improved conditions at that intersection with the roundabout. No mitigation is proposed for this intersection.

[5] Kuhio Highway/Hauaala Road

The eastbound approach is expected to continue operating at LOS F during both peak hours and at overcapacity during the AM peak hour. Similar to Base Year 2027, although a signal may be warranted at this intersection, it may create longer delays. However, the intersection is expected to self-regulate as in existing conditions to reduce delay to the eastbound approach. Additionally, a larger portion of vehicles may use Mailihuna Road to access Kuhio Highway due to the improved conditions at that intersection with the roundabout. No mitigation is proposed for this intersection.

[7] Kuhio Highway/Lehua Street

The eastbound approach is expected to continue operating at LOS F and under capacity during both peak hours of traffic. The intersection is expected to self-regulate as in existing conditions to reduce delay to the eastbound approach. No mitigation is proposed for this intersection.



[8] Kuhio Highway/Niu Street

The minor street approaches are expected to continue operating at or worsen to LOS E(F) during both peak hours of traffic. As in Base Year 2027 conditions, adequate gaps in traffic are expected due the intersection's proximity to the Kukui Street signal, and the minor street movements are expected to continue operating adequately. No mitigation is proposed at this intersection.

[9] Kuhio Highway/Kukui Street

The northbound shared through/right-turn movement will continue operating at overcapacity during both peak hours of traffic with increases in delay. Additionally, both minor street approaches are expected to continue operating at LOS E or F during both peak hours of traffic. Because there is limited ROW to improve capacity along Kuhio Highway and the minor streets will continue to operate under capacity, no mitigation is proposed for this intersection.

Figure 5.5 illustrates the Future Year 2027 forecast traffic volumes and LOS for the study intersection movements. Table 5.4 summarizes the Future Year 2027 LOS at the study intersections compared to Base Year 2027 conditions. Both Figure 5.5 and Table 5.4 reflect conditions without the Kapaa Bypass Road extension. LOS worksheets are provided in Appendix C.

5.4 Future Year 2027 With Mitigation Analysis

Similar to Base Year 2027 conditions, traffic signals may be warranted at the intersection of Kuhio Highway with Kawaihau Road and Hauaala Road. However, for similar reasons described in section 4.5.2, signals were not assumed.

For both the with Kapaa Bypass Road extension and without Kapaa Bypass Road extension scenarios, the following mitigations were considered at the Kuhio Highway/Kealia Road intersection to improve traffic operations.

- Install a traffic signal
- Construct a roundabout

5.4.1 Kuhio Highway/Kealia Road Traffic Signal

This improvement is anticipated to include the installation of a traffic signal along with pedestrian signals and crosswalks and a southbound right-turn deceleration lane onto Kealia Road. Based on projections for Future Year 2027 and the Four-Hour Vehicular Volume signal warrant condition (Warrant 2) in the Manual on Uniform Traffic Control Devices (MUTCD), Federal Highway Administration, dated 2009, a signal is anticipated to warrant at this intersection with the Project given the existing lane configuration. The signal warrant is included in Appendix D. Although a signal would slow through progression along Kuhio Highway when vehicles actuate the signal along Kealia Road, the signal would be designed to provide Kuhio Highway with the majority of green time. Additionally, because the Kuhio Highway/Kealia Road intersection is relatively isolated, queuing at the signal is not expected to negatively impact traffic operations in the area. A southbound right-turn lane is also proposed with the traffic signal to remove right-turning vehicles from the flow of through traffic and provide a deceleration lane.



A traffic signal would provide pedestrians and bicyclists with a designated crossing time which is expected to reduce the potential for vehicular conflicts. At the Kuhio Highway/Kealia Road intersection, pedestrians and bicyclists would be able to cross Kuhio Highway to access the Ke Ala Hele Makalae Multi-Use Path or cross Kealia Road to the sidewalk along the mauka side of the highway.

Realignment of Kealia Road was considered to eliminate the skewed approach at the intersection in order to facilitate turning movements to and from the minor roadways. The skewed approach could be eliminated by realigning Kealia Road with the southbound right-turn channelized lane from Kuhio Highway and the dirt road just makai of Kealia Road at the subject intersection. The realignment would have the following impacts at the intersection:

- Realignment of the Kealia Beach access to align with Kealia Road
- Bus stop/shelter relocation
- Electrical utility pole relocation
- Reduction in southbound left-turn storage/deceleration length by approximately 100 feet

While the southbound left-turn storage length would continue to be adequate with the anticipated realignment, the shorter deceleration length would be undesirable. Given the grade differentials on both sides of Kuhio Highway just north of the Kuhio Highway/Kealia Road intersection, widening the highway to accommodate lengthening the southbound left-turn lane in addition to providing a southbound right-turn deceleration lane would be challenging. Therefore, realigning the intersection to eliminate the skewed Kealia Road approach was ultimately not evaluated in the traffic signal alternative.

Although the initial construction costs for a traffic signal and southbound right-turn deceleration lane without intersection realignment are expected to be lower than for a roundabout, the County of Kauai has indicated a preference for a roundabout at this intersection.

With a traffic signal, the intersection is expected to operate with all movements at LOS C or better during both peak hours of traffic. Delay to the mainline Kuhio Highway movements are anticipated to operate on average with less than 15 seconds of delay. Based on the American Association of State Highway and Transportation Officials (AASHTO) A Policy on Geometric Design of Highways and Streets (“Green Book”), dated 2011, 60 feet is needed for the southbound left-turn storage and 225 feet is needed for the northbound left-turn storage. For the northbound left-turn lane, it appears that additional length for deceleration can be provided through restriping.

Figure 5.7 shows the existing intersection configuration at Kuhio Highway/Kealia Road and the potential improvements recommended with the installation of a traffic signal. Table 5.6 summarizes the Future Year 2027 without mitigation and Future Year 2027 with traffic signal scenarios at the Kuhio Highway/Kealia Road intersection. Note that this intersection will not be affected by the Kapaa Bypass Road extension.



Table 5.5: Kuhio Highway/Kealia Road Left-Turn Storage Lengths

Movement	Peak Hour	Design Volume per lane (veh)	Cycle Length (sec)	Cycles per Hour	Avg. Veh. per Cycle	Minimum Storage Length (1.5 factor) ¹		Recommended storage length ²
						Veh	Ft	
						Northbound Left-turn lane	AM	
PM	175	120	30	6	9		225	
Southbound Left-turn lane	AM	10	120	30	1	1	60	60 ft Storage Recommended
	PM	20	120	30	1	1	60	

Notes:

1. Minimum storage length is 1.5 times the average number of vehicles per cycle; assume 1 vehicle length = 25 ft.
2. Recommended storage length is exclusive of taper length or deceleration length. To be verified upon design.

Table 5.6: Kuhio Highway/Kealia Road Traffic Signal Level of Service Summary

Intersection	Future Year 2027						Future Year 2027 with Mitigation - Traffic Signal					
	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
2. Kuhio Hwy & Kealia Rd												
NB LT	10.2	0.09	B	12.3	0.28	B	9.2	0.17	A	13.6	0.53	B
NB TH/RT	-	-	-	-	-	-	8.3	0.72	A	7.5	0.73	A
EB LT/TH/RT	304.7	1.45	F*	314.9	1.40	F*	25.7	0.57	C	29.0	0.53	C
WB LT/TH/RT	237.4	0.87	F	1535.3	3.26	F*	22.0	0.11	C	26.0	0.17	C
SB LT	9.6	0.01	A	9.9	0.03	A	7.1	0.03	A	6.4	0.06	A
SB TH	-	-	-	-	-	-	12.6	0.83	B	11.8	0.85	B
SB RT	-	-	-	-	-	-	5.8	0.02	A	4.8	0.03	A
<i>Overall</i>	31.8	-	-	51.3	-	-	11.9	-	B	11.4	-	B

* Denotes overcapacity condition v/c ≥ 1.

5.4.2 Kuhio Highway/Kealia Road Roundabout

A roundabout concept was prepared in response to comments from the County of Kauai. Although many alternative layouts are possible, the purpose of the concept was to demonstrate some of the issues that may be encountered as a result of the roundabout's larger footprint and roadway realignments. The concept, shown in Figure 5.8, strives to generally maintain the existing alignment of the approach roadways while keeping the roundabout footprint within the existing pavement on the makai side of the intersection. Although the roundabout encroaches into right-of-way (ROW) mauka of the highway ROW, these lands are owned by the Project developer, and it was assumed that land affected by the roundabout would be dedicated to the



State. The following impacts are anticipated, and are likely to make the roundabout significantly more costly to construct than a traffic signal:

- Realignment of the northbound approach of Kuhio Highway to keep the roundabout footprint within the existing pavement on the makai side.
- Southbound right-turn bypass lane required due to acute angle between Kealia Road and Kuhio Highway
- Bus stop/shelter relocation
- Electrical utility pole relocation
- Reconstruction of Kealia Surf Shack signs and fences

It should also be noted that other design enhancements may be required to reduce speed upstream of the roundabout – particularly in the southbound direction where speeds are higher. Positioning the roundabout more inland would also likely require areas mauka of Kuhio Highway to be regraded as a result of the steep slope that exists mauka of Kuhio Highway.

With a roundabout, pedestrians and bicyclists will have shorter crossing distances with the provision of medians and removal of left-turn lanes along the highway. In addition, the medians will allow pedestrians to cross the roadways, namely Kuhio Highway, in two stages. Crosswalks are proposed along the northbound, southbound and eastbound approaches, which will allow pedestrians and bicyclists to cross the highway to access the Ke Ala Hele Makalae Multi-Use Path or cross Kealia Road to access the sidewalk along the mauka side of Kuhio Highway. Bicyclists that prefer to travel in the vehicular travel lanes would follow the same paths through the roundabout as vehicles.

All movements are anticipated to operate at LOS B or better during the AM peak hour of traffic with the proposed roundabout concept. During the PM peak hour, the southbound through movement is anticipated to operate at LOS D. Increased delay is expected for the southbound approach due to the high volumes along Kuhio Highway required to share priority with the lower volume Kealia Road.

Figure 5.8 shows a conceptual layout of the proposed roundabout at the Kuhio Highway/Kealia Road intersection. In addition, Figure 5.9 shows the anticipated impacts, as described above, to the intersection as a result of the roundabout. Table 5.7 summarizes the Future Year 2027 without mitigation and Future Year 2027 with roundabout scenarios at the Kuhio Highway/Kealia Road intersection. Note that this intersection will not be affected by the Kapaa Bypass Road extension.



Table 5.7: Kuhio Highway/Kealia Road Roundabout Level of Service Summary

Intersection	Future Year 2027						Future Year 2027 with Mitigation - 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
2. Kuhio Hwy & Kealia Rd												
NB LT	10.2	0.09	B	12.3	0.28	B	-	-	-	-	-	-
NB LT/TH	-	-	-	-	-	-	11.5	0.68	B	16.1	0.80	C
EB LT/TH/RT	304.7	1.45	F*	314.9	1.40	F*	-	-	-	-	-	-
EB LT/RT	-	-	-	-	-	-	10.9	0.32	B	11.0	0.26	B
WB LT/TH/RT	237.4	0.87	F	1535.3	3.26	F*	-	-	-	-	-	-
SB LT	9.6	0.01	A	9.9	0.03	A	-	-	-	-	-	-
SB TH	-	-	-	-	-	-	12.2	0.69	B	27.3	0.90	D
SB RT	-	-	-	-	-	-	2.8	0.01	A	3.3	0.03	A
<i>Overall</i>	31.8	-	-	51.3	-	-	11.7	-	B	20.6	-	C

* Denotes overcapacity condition v/c ≥ 1.

5.4.3 Future Year 2027 with Mitigation Intersection Analysis

Based on the above considerations, either a traffic signal or roundabout would provide adequate mitigation at the Kuhio Highway/Kealia Road intersection for vehicular, bicycle and pedestrian traffic. For the purposes of this report, a roundabout was assumed to be the preferred alternative as the County of Kauai has previously indicated preference of a roundabout over a traffic signal at the intersection. However, it should be noted that a traffic signal would also provide adequate mitigation and may be considered if agreeable to the developer, County, State and other community groups.

Anticipated mitigation measures required as part of the roundabout are as follows. It should be noted that the proposed mitigation is based off of the single conceptual roundabout design evaluated as part of this study. Actual improvements required will depend on the final roundabout design.

[2] Kuhio Highway/Kealia Road

- Construct a single-lane, three-leg roundabout.
 - Realign the skewed eastbound approach of Kealia Road.
 - Realign the northbound approach of Kuhio Highway.
 - Provide a southbound right-turn bypass onto Kealia Road prior to the roundabout.
 - Relocate the existing northbound and southbound bus stops/bus bays along Kealia Road to south of the intersection.
 - Relocate electrical utility poles.
 - Reconstruct the Kealia Surf Shack signs and fences at the northwest corner of the intersection.
 - Provide crosswalks along all three (3) approaches.

With the proposed mitigation, all approaches will operate at LOS D or better during both peak hours of traffic. Additionally, the intersection will operate with overall LOS B/C during the AM/PM peak hours.

Figures 5.3 and 5.6 illustrate the Future Year 2027 with mitigation forecast traffic volumes and LOS for the study intersection movements. Tables 5.3 and 5.4 summarize the Future Year 2027 with mitigation LOS at the study intersections compared to Future Year 2027 without mitigation. Figure 5.3 and Table 5.3 reflect conditions with the Kapaa Bypass Road extension and Figure 5.6 and Table 5.4 reflect conditions without the Kapaa Bypass Road extension. LOS worksheets are provided in Appendix C.

5.5 Future Year 2027 Sustainable Transportation

The Project proposes to construct improvements along Kealia Road in the vicinity of the Project, including the addition of a sidewalk providing access between the Project and Kuhio Highway. The proposed roadway cross section includes widening the existing right-of-way (ROW) from 40 feet to 56 feet to provide two (2) 10-foot vehicular travel lanes, 5-foot paved shoulders on each side of the roadway, a 5-foot wide concrete sidewalk on the mauka bound side of the roadway and green space between the paved road shoulder and sidewalk. The paved shoulder may be utilized by bicyclists who are uncomfortable using the vehicular travel lane.

In addition to the planned improvements along Kealia Road, the construction of a roundabout at the Kuhio Highway/Kealia Road intersection will provide shorter crossing distances with median refuges along all approaches. A roundabout may also help to reduce speeds along the highway at this intersection, although additional design enhancements may be necessary to reduce speeds prior to entering the roundabout. The existing bus stops at the intersection will continue to be provided, however, the existing bus bays for the northbound and southbound approaches of Kuhio Highway will be relocated just south of the intersection.

As noted in Section 5.4.3, although a roundabout is assumed as the preferred mitigation at the Kuhio Highway/Kealia Road intersection, a traffic signal would also provide adequate mitigation at the intersection and may be considered if agreeable to all parties involved. A traffic signal would also benefit pedestrians by providing signalized crossings along all approaches. As with the roundabout improvement, the existing southbound bus stop/bus bay would need to be relocated to south of the intersection.

With the proposed improvements, pedestrian and bicycle traffic will be able to access bus stops and the Ke Ala Hele Makalae Multi-Use Path, which will allow them to travel further north and south of the Project area. As discussed in Section 3.2, pedestrians and cyclists were observed to favor the multi-use path over travel along the highway. Pedestrians and cyclists will also be able to access nearby residential areas and schools from the multi-use path via the Kawaihau Road spur or via the Mailihuna Road connection proposed with the construction of the roundabout.

No additional improvements to pedestrian and bicycle facilities are recommended for Future Year 2027.



NOT TO SCALE

NOTE:

THIS DRAWING IS FOR ILLUSTRATIVE PURPOSES ONLY. DO NOT USE FOR CONSTRUCTION.

LEGEND

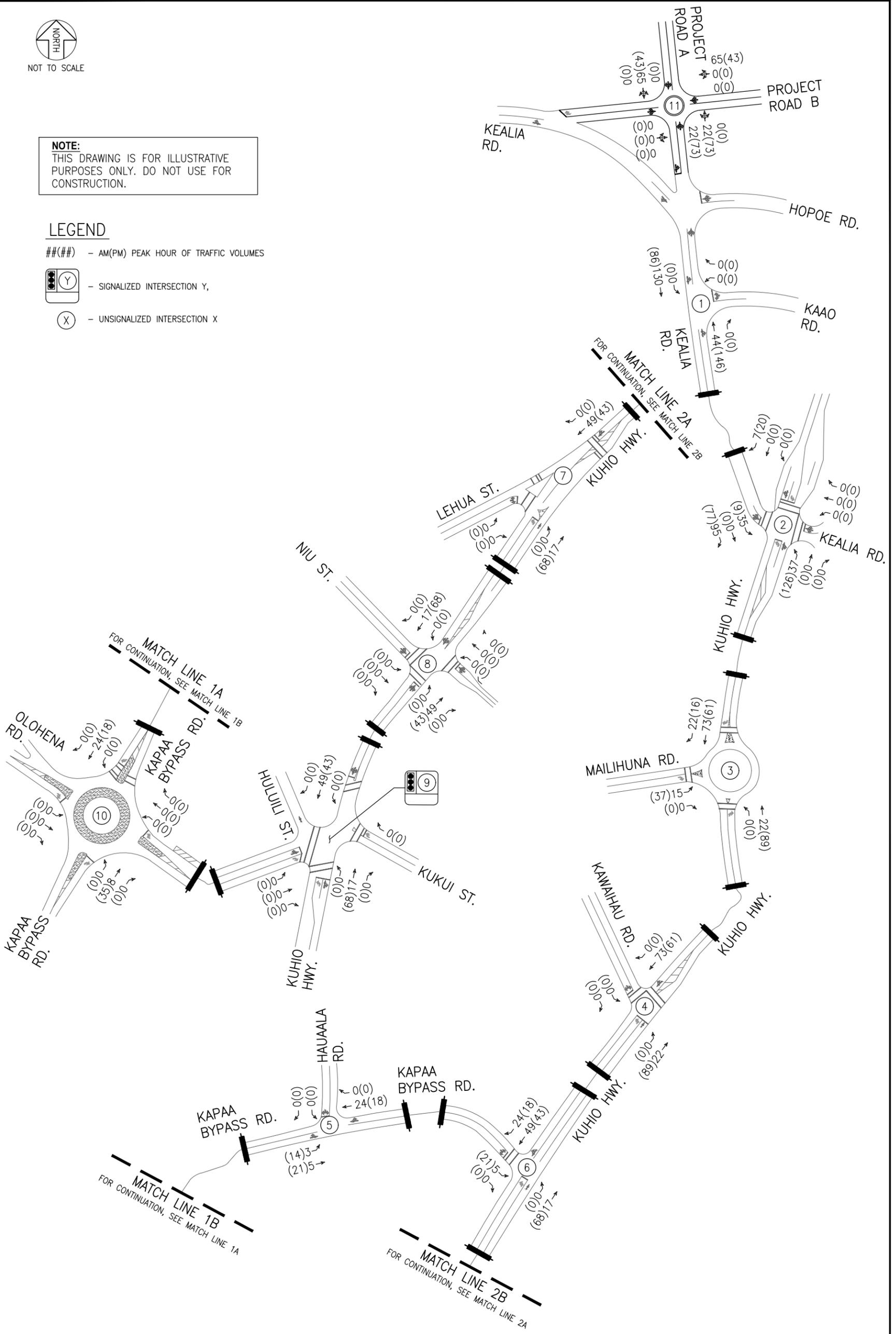
##(##) - AM(PM) PEAK HOUR OF TRAFFIC VOLUMES



- SIGNALIZED INTERSECTION Y,



- UNSIGNALIZED INTERSECTION X



KEALIA MAUKA HOMESITES TIAR

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

**YEAR 2027 PROJECT-GENERATED TRAFFIC
(WITH KAPAA BYPASS ROAD EXTENSION)**

FIGURE

5.1



NOT TO SCALE

NOTE:

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LEGEND

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

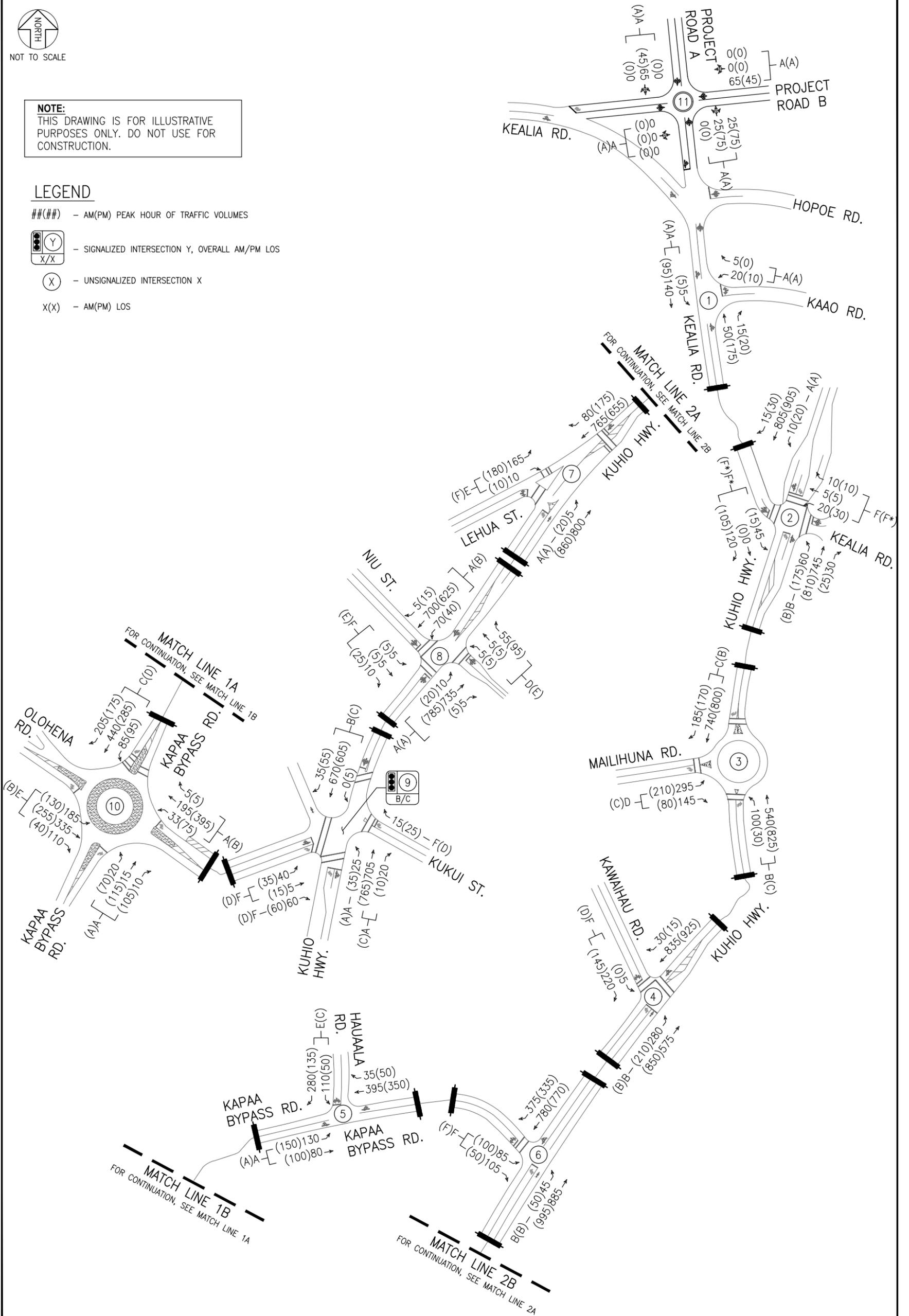


- SIGNALIZED INTERSECTION Y, OVERALL AM/PM LOS



- UNSIGNALIZED INTERSECTION X

X(X) - AM(PM) LOS



KEALIA MAUKA HOMESITES TIARA

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

FUTURE YEAR 2027 LANE CONFIGURATION, VOLUMES AND MOVEMENT LOS (WITH KAPAA BYPASS ROAD EXTENSION)

FIGURE

5.2



NOT TO SCALE

NOTE:

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LEGEND

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



- SIGNALIZED INTERSECTION Y, OVERALL AM/PM LOS



- UNSIGNALIZED INTERSECTION X

X(X) - AM(PM) LOS

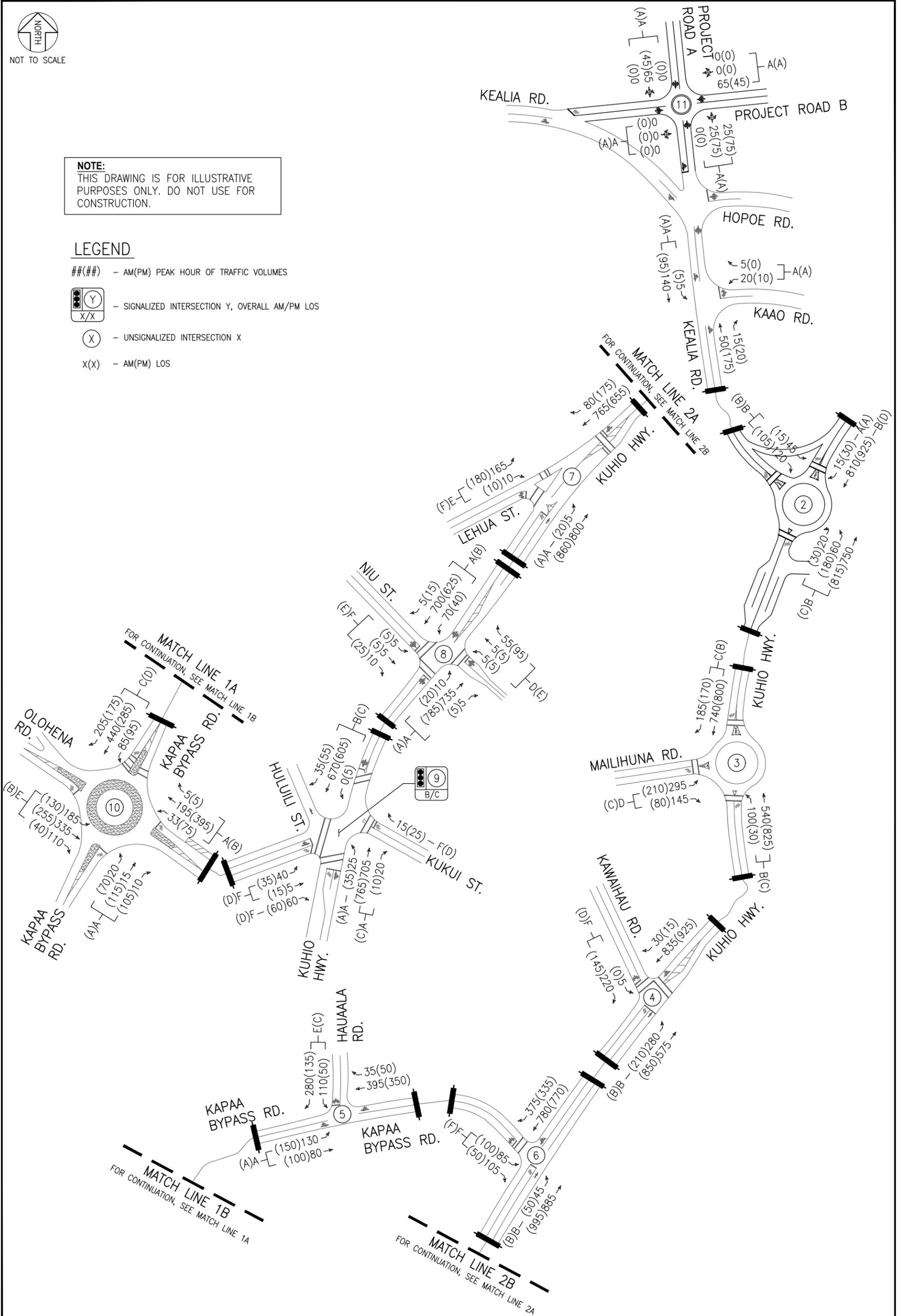


Table 5.3: Base Year 2027 with Mitigation, Future Year 2027 and Future Year 2027 with Mitigation Level of Service Summary (With Kapaa Bypass Extension)

Intersection	Base Year 2027 with Mitigation (With Kapaa Bypass Extension)						Future Year 2027 (With Kapaa Bypass Extension)						Future Year 2027 with Mitigation (With Kapaa Bypass Extension)																	
	AM			PM			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	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS												
1: Kealia Rd & Kaao Rd	Same as Future Year 2027																													
WB LT/RT																			8.7	0.03	A	8.9	0.01	A	9.7	0.03	A	10.4	0.02	B
SB LT/TH																			7.3	0.00	A	7.3	0.00	A	7.4	0.00	A	7.7	0.00	A
<i>Overall</i>	4.2	-	-	1.7	-	-	1.2	-	-	0.5	-	-																		
2: Kuhio Hwy & Kealia Rd	Same as Future Year 2027																													
NB LT																			9.8	0.03	A	10.6	0.08	B	10.2	0.09	B	12.3	0.28	B
NB LT/TH																			-	-	-	-	-	-	-	-	-	-	-	-
EB LT/TH/RT																			39.7	0.27	E	40.4	0.27	E	304.7	1.45	F*	314.9	1.40	F*
EB LT/RT																			-	-	-	-	-	-	-	-	-	-	-	-
WB LT/TH/RT																			88.9	0.49	F	315.8	1.11	F*	237.4	0.87	F	1535.3	3.26	F*
SB LT																			9.6	0.01	A	9.9	0.03	A	9.6	0.01	A	9.9	0.03	A
SB TH																			-	-	-	-	-	-	-	-	-	-	-	-
SB RT																			-	-	-	-	-	-	-	-	-	-	-	-
<i>Overall</i>	2.8	-	-	8.6	-	-	31.8	-	-	51.3	-	-																		
3: Kuhio Hwy & Mailihuna Rd	Same as Future Year 2027																													
NB LT/TH																			12.7	0.64	B	13.8	0.71	B	14.1	0.68	B	20.6	0.83	C
EB LT/RT																			19.2	0.68	C	12.2	0.43	B	25.4	0.76	D	15.7	0.54	C
SB TH/RT																			13.3	0.72	B	12.4	0.71	B	16.7	0.79	C	14.8	0.77	B
<i>Overall</i>	14.4	-	B	12.9	-	B	17.8	-	C	17.3	-	C																		
4: Kuhio Hwy & Kawaihau Rd	Same as Future Year 2027																													
NB LT																			12.7	0.40	B	12.5	0.32	B	13.7	0.42	B	13.1	0.34	B
EB LT/RT																			54.8	0.82	F	27.9	0.51	D	81.2	0.93	F	32.2	0.55	D
<i>Overall</i>	8.6	-	-	3.3	-	-	11.4	-	-	3.5	-	-																		
5: Kapaa Bypass Rd & Hauaala Rd	Same as Future Year 2027																													
EB LT/TH																			8.7	0.12	A	8.6	0.13	A	8.8	0.13	A	8.7	0.15	A
SB LT/RT																			41.7	0.86	E	16.6	0.39	C	49.8	0.90	E	17.8	0.42	C
<i>Overall</i>	17.4	-	-	5.4	-	-	20.0	-	-	5.5	-	-																		
6: Kuhio Hwy & Kapaa Bypass Rd	Same as Future Year 2027																													
NB LT																			11.6	0.08	B	11.4	0.09	B	12.2	0.09	B	11.8	0.09	B
EB LT/RT																			58.0	0.80	F	42.1	0.61	E	75.5	0.88	F	66.5	0.79	F
<i>Overall</i>	5.2	-	-	2.8	-	-	6.6	-	-	4.6	-	-																		
7: Kuhio Hwy & Lehua St	Same as Future Year 2027																													
NB LT																			9.7	0.01	A	9.8	0.03	A	9.9	0.01	A	10.0	0.03	A
EB LT/RT																			35.9	0.64	E	44.1	0.72	E	39.7	0.67	E	53.4	0.78	F
<i>Overall</i>	3.6	-	-	4.8	-	-	3.9	-	-	5.4	-	-																		
8: Kuhio Hwy & Niu St	Same as Future Year 2027																													
NB LT/TH/RT																			9.2	0.01	A	9.2	0.03	A	9.4	0.01	A	9.3	0.03	A
EB LT/TH/RT																			49.6	0.21	E	35.4	0.24	E	56.6	0.24	F	44.2	0.30	E
WB LT/TH/RT																			29.6	0.33	D	29.6	0.44	D	32.5	0.35	D	36.1	0.51	E
SB LT/TH/RT																			9.9	0.09	A	9.9	0.06	A	10.0	0.10	A	10.2	0.06	B
<i>Overall</i>	2.4	-	-	3.2	-	-	2.5	-	-	3.6	-	-																		

Table 5.3: Base Year 2027 with Mitigation, Future Year 2027 and Future Year 2027 with Mitigation Level of Service Summary (With Kapaa Bypass Extension)
Cont'd

Intersection	Base Year 2027 with Mitigation (With Kapaa Bypass Extension)						Future Year 2027 (With Kapaa Bypass Extension)						Future Year 2027 with Mitigation (With Kapaa Bypass Extension)					
	AM			PM			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	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS
9: Kuhio Hwy & Kukui St**																		
NB LT	2.3	0.04	A	3.7	0.07	A	2.6	0.05	A	3.8	0.07	A	Same as Future Year 2027					
NB TH/RT	8.2	0.74	A	16.5	0.83	B	8.7	0.75	A	24.8	0.92	C						
EB LT/TH	96.1	0.41	F	45.6	0.22	D	96.1	0.41	F	45.6	0.22	D						
EB RT	91.6	0.04	F	44.1	0.05	D	91.6	0.04	F	44.1	0.05	D						
WB RT	91.3	0.01	F	43.9	0.02	D	91.3	0.01	F	43.9	0.02	D						
SB LT/TH/RT	10.5	0.72	B	19.9	0.81	B	12.4	0.77	B	24.9	0.87	C						
<i>Overall</i>	15.8	-	B	20.2	-	C	16.7	-	B	26.1	-	C						
10: Kapaa Bypass Rd/Cane Haul Rd & Olohena Rd																		
NB LT/TH/RT	5.9	0.06	A	8.8	0.35	A	5.9	0.07	A	9.6	0.40	A	Same as Future Year 2027					
EB LT/TH/RT	40.9	0.93	E	12.6	0.56	B	46.7	0.95	E	13.1	0.57	B						
WB LT/TH/RT	5.7	0.24	A	10.2	0.52	B	5.7	0.24	A	11.0	0.55	B						
SB LT/TH/RT	17.1	0.75	C	25.4	0.80	D	18.5	0.78	C	27.4	0.82	D						
<i>Overall</i>	24.5	-	C	15.5	-	C	27.2	-	D	16.5	-	C						
11: Project Road A & Project Road B																		
NB LT/TH/RT							3.1	0.05	A	3.7	0.13	A	Same as Future Year 2027					
EB LT/TH/RT							3.2	0.01	A	3.0	0.01	A						
WB LT/TH/RT							3.2	0.06	A	3.3	0.05	A						
SB LT/TH/RT							3.4	0.07	A	3.2	0.05	A						
<i>Overall</i>							3.2	-	A	3.5	-	A						

* Denotes overcapacity condition, v/c ≥ 1.

** Intersection analyzed using HCM 2000 methodology due to HCM 6th Edition methodology currently not supporting signalized intersections with a stop-controlled, right-turn only approach.



NOT TO SCALE

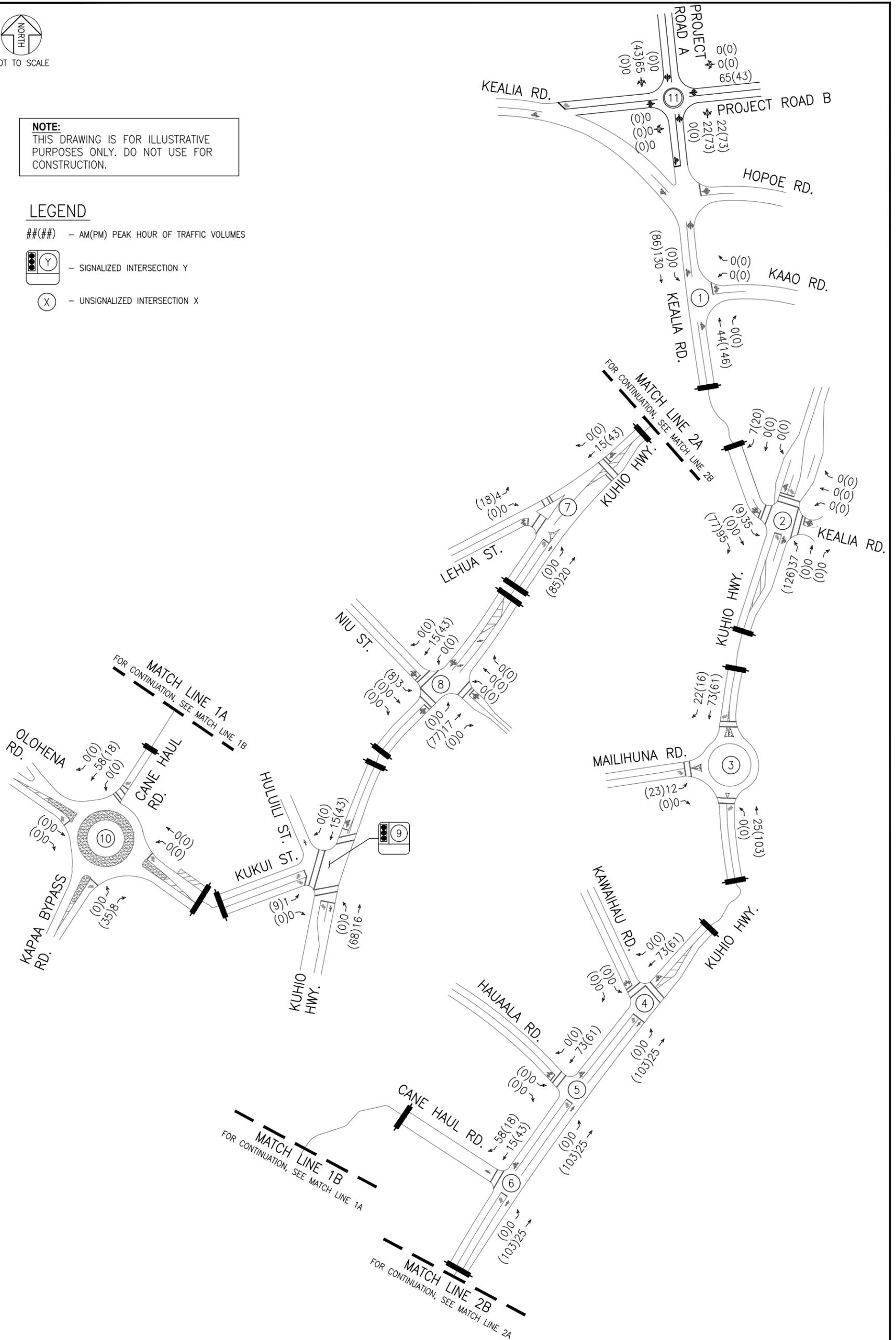
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LEGEND

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

 - SIGNALIZED INTERSECTION Y

 - UNSIGNALIZED INTERSECTION X



KEALIA MAUKA HOMESITES TIAR

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

**YEAR 2027 PROJECT-GENERATED TRAFFIC
(WITHOUT KAPAA BYPASS ROAD EXTENSION)**

FIGURE

5.4



NOT TO SCALE

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LEGEND

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

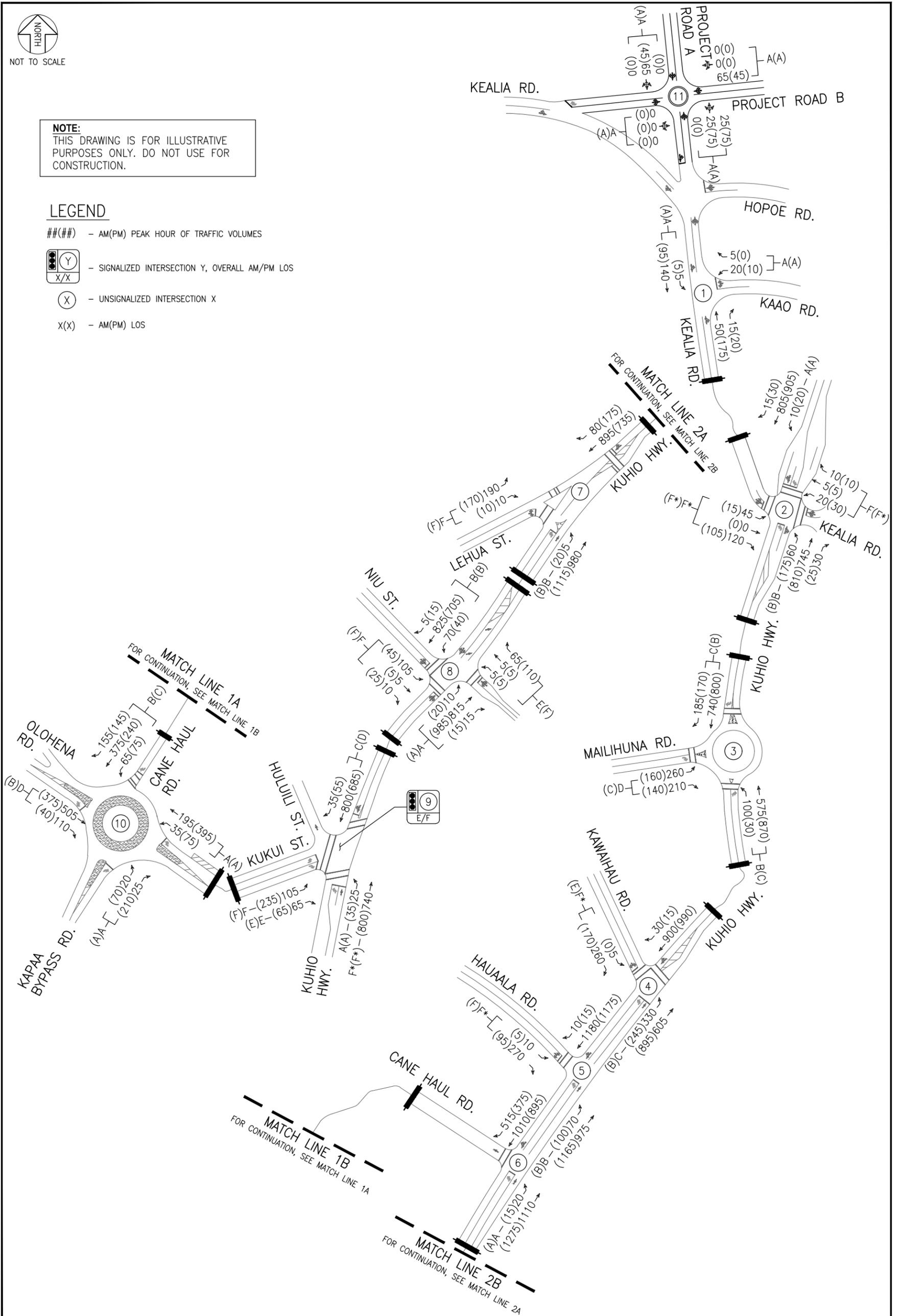


- SIGNALIZED INTERSECTION Y, OVERALL AM/PM LOS



- UNSIGNALIZED INTERSECTION X

X(X) - AM(PM) LOS



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FUTURE YEAR 2027 LANE CONFIGURATION, VOLUMES AND MOVEMENT LOS (WITHOUT KAPAA BYPASS ROAD EXTENSION)

FIGURE

5.5



NOT TO SCALE

NOTE:

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LEGEND

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

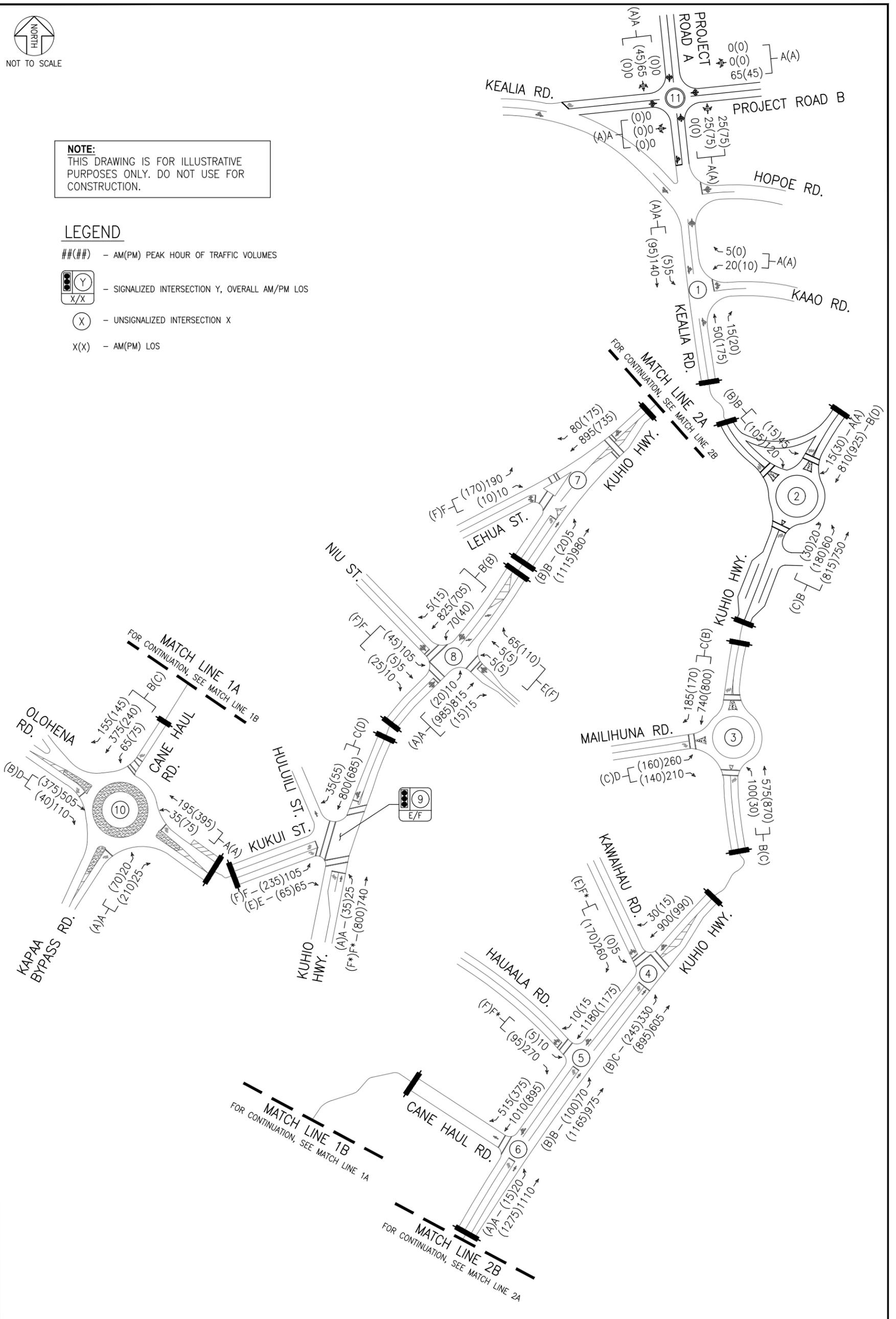


- SIGNALIZED INTERSECTION Y, OVERALL AM/PM LOS



- UNSIGNALIZED INTERSECTION X

X(X) - AM(PM) LOS



KEALIA MAUKA HOMESITES TIAR

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ENGINEERS, SURVEYORS HONOLULU, HAWAII

FUTURE YEAR 2027 WITH MITIGATION LANE CONFIGURATION, VOLUMES AND MOVEMENT LOS - (WITHOUT KAPAA BYPASS ROAD EXTENSION)

FIGURE

5.6

Table 5.4: Base Year 2027 with Mitigation, Future Year 2027 and Future Year 2027 with Mitigation Level of Service Summary (Without Kapaa Bypass Extension)

Intersection	Base Year 2027 with Mitigation (Without Kapaa Bypass Extension)						Future Year 2027 (Without Kapaa Bypass Extension)						Future Year 2027 with Mitigation (Without Kapaa Bypass Extension)																	
	AM			PM			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	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS												
1: Kealia Rd & Kaao Rd	Same as Future Year 2027																													
WB LT/RT																			8.7	0.03	A	8.9	0.01	A	9.7	0.03	A	10.4	0.02	B
SB LT/TH																			7.3	0.00	A	7.3	0.00	A	7.4	0.00	A	7.7	0.00	A
<i>Overall</i>	4.2	-	-	1.7	-	-	1.2	-	-	0.5	-	-																		
2: Kuhio Hwy & Kealia Rd	Same as Future Year 2027																													
NB LT																			9.8	0.03	A	10.6	0.08	B	10.2	0.09	B	12.3	0.28	B
NB LT/TH																			-	-	-	-	-	-	-	-	-	-	-	-
EB LT/TH/RT																			39.7	0.27	E	40.4	0.27	E	304.7	1.45	F*	314.9	1.40	F*
EB LT/RT																			-	-	-	-	-	-	-	-	-	-	-	-
WB LT/TH/RT																			88.9	0.49	F	315.8	1.11	F*	237.4	0.87	F	1535.3	3.26	F*
SB LT																			9.6	0.01	A	9.9	0.03	A	9.6	0.01	A	9.9	0.03	A
SB TH																			-	-	-	-	-	-	-	-	-	-	-	-
SB RT																			-	-	-	-	-	-	-	-	-	-	-	-
<i>Overall</i>	2.8	-	-	8.6	-	-	31.8	-	-	51.3	-	-																		
3: Kuhio Hwy & Mailihuna Rd	Same as Future Year 2027																													
NB LT/TH																			12.8	0.66	B	13.7	0.72	B	14.1	0.69	B	19.6	0.83	C
EB LT/RT																			22.3	0.74	C	13.4	0.48	B	30.0	0.81	D	16.2	0.55	C
SB TH/RT																			13.3	0.72	B	12.4	0.71	B	16.7	0.79	C	14.8	0.77	B
<i>Overall</i>	15.3	-	C	13.1	-	B	18.9	-	C	17.0	-	C																		
4: Kuhio Hwy & Kawaihau Rd	Same as Future Year 2027																													
NB LT																			14.8	0.50	B	13.9	0.40	B	16.2	0.53	C	14.8	0.42	B
EB LT/RT																			134.5	1.12	F*	38.8	0.65	E	201.3	1.29	F*	47.3	0.71	E
<i>Overall</i>	19.9	-	-	4.7	-	-	27.5	-	-	5.0	-	-																		
5: Kuhio Hwy & Hauaala Rd	Same as Future Year 2027																													
NB LT																			12.3	0.13	B	13.0	0.19	B	12.9	0.14	B	13.6	0.21	B
EB LT/RT																			323.2	1.57	F*	67.0	0.69	F	415.0	1.77	F*	129.0	0.91	F
<i>Overall</i>	38.4	-	-	4.7	-	-	47.3	-	-	7.5	-	-																		
6: Kuhio Hwy & Cane Haul Rd**	Same as Future Year 2027																													
NB LT/TH																			1.7	0.05	A	0.9	0.03	A	1.8	0.06	A	1.0	0.03	A
<i>Overall</i>	0.3	0.84	E	0.2	0.70	C	0.3	0.88	E	0.2	0.73	D																		
7: Kuhio Hwy & Lehua St	Same as Future Year 2027																													
NB LT																			10.5	0.01	B	10.2	0.03	B	10.6	0.01	B	10.4	0.03	B
EB LT/RT																			89.2	0.94	F	89.6	0.94	F	92.1	0.95	F	101.2	0.96	F
<i>Overall</i>	8.7	-	-	8.7	-	-	8.6	-	-	8.3	-	-																		
8: Kuhio Hwy & Niu St	Same as Future Year 2027																													
NB LT/TH/RT																			9.9	0.02	A	9.5	0.03	A	10.0	0.02	A	9.7	0.03	A
EB LT/TH/RT																			119.7	0.95	F	128.8	0.95	F	129.5	0.96	F	161.0	0.93	F
WB LT/TH/RT																			40.6	0.45	E	44.2	0.60	E	47.4	0.50	E	83.2	0.81	F
SB LT/TH/RT																			10.2	0.10	B	10.5	0.06	B	10.5	0.10	B	11.4	0.07	B
<i>Overall</i>	10.3	-	-	11.4	-	-	10.3	-	-	11.5	-	-																		

Table 5.4: Base Year 2027 with Mitigation, Future Year 2027 and Future Year 2027 with Mitigation Level of Service Summary (Without Kapaa Bypass Extension)
Cont'd

Intersection	Base Year 2027 with Mitigation (Without Kapaa Bypass Extension)						Future Year 2027 (Without Kapaa Bypass Extension)						Future Year 2027 with Mitigation (Without Kapaa Bypass Extension)					
	AM			PM			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	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS
9: Kuhio Hwy & Kukui St**																		
NB LT	4.3	0.06	A	4.7	0.07	A	5.2	0.06	A	9.9	0.09	A	Same as Future Year 2027					
NB TH	86.8	1.13	F*	83.3	1.11	F*	102.8	1.17	F*	207.9	1.39	F*						
EB LT	87.7	0.62	F	112.1	0.87	F	92.1	0.70	F	124.9	0.94	F						
EB RT	76.3	0.05	E	70.8	0.06	E	74.4	0.05	E	72.1	0.08	E						
SB TH/RT	27.5	0.93	C	20.5	0.83	C	34.3	0.96	C	42.1	0.94	D						
<i>Overall</i>	56.9	-	E	57.5	-	E	67.4	-	E	123.6	-	F						
10: Kapaa Bypass Rd/Cane Haul Rd & Olohena Rd																		
NB LT/RT	5.6	0.06	A	8.2	0.33	A	5.8	0.07	A	9.0	0.38	A	Same as Future Year 2027					
EB TH/RT	22.1	0.79	C	10.7	0.51	B	28.3	0.85	D	11.1	0.52	B						
WB LT/TH	4.3	0.19	A	6.9	0.41	A	4.3	0.19	A	6.9	0.41	A						
SB LT/TH/RT	10.9	0.57	B	16.9	0.65	C	12.6	0.63	B	18.2	0.68	C						
<i>Overall</i>	14.6	-	B	10.9	-	B	17.6	-	C	11.5	-	B						
11: Project Road A & Project Road B																		
NB LT/TH/RT							3.0	0.04	A	3.6	0.12	A	Same as Future Year 2027					
EB LT/TH/RT							3.0	0.00	A	2.9	0.00	A						
WB LT/TH/RT							3.1	0.05	A	3.2	0.04	A						
SB LT/TH/RT							3.3	0.06	A	3.1	0.04	A						
<i>Overall</i>							3.2	-	A	3.5	-	A						

* Denotes overcapacity condition, v/c ≥ 1.

** Intersection analyzed using HCM 2000 methodology due to HCM 6th Edition methodology currently not supporting signalized intersections with a stop-controlled, right-turn only approach or unsignalized intersections without at least one stop-controlled approach.



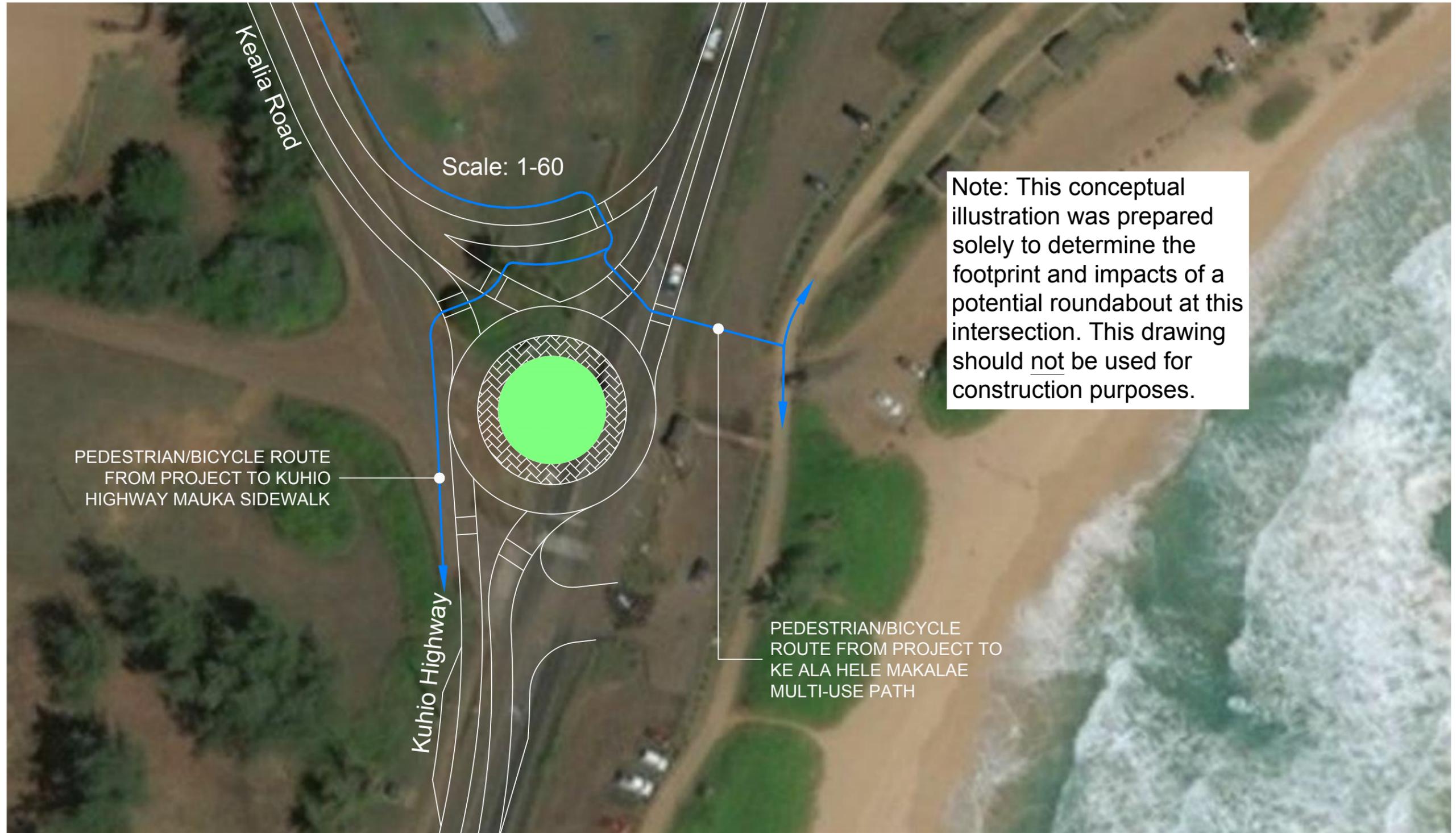
JANUARY 31, 2019

KEALIA MAUKA HOMESITES TIAR

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

KUHIO HIGHWAY AND KEALIA ROAD MITIGATION -
TRAFFIC SIGNAL

FIGURE
5.7



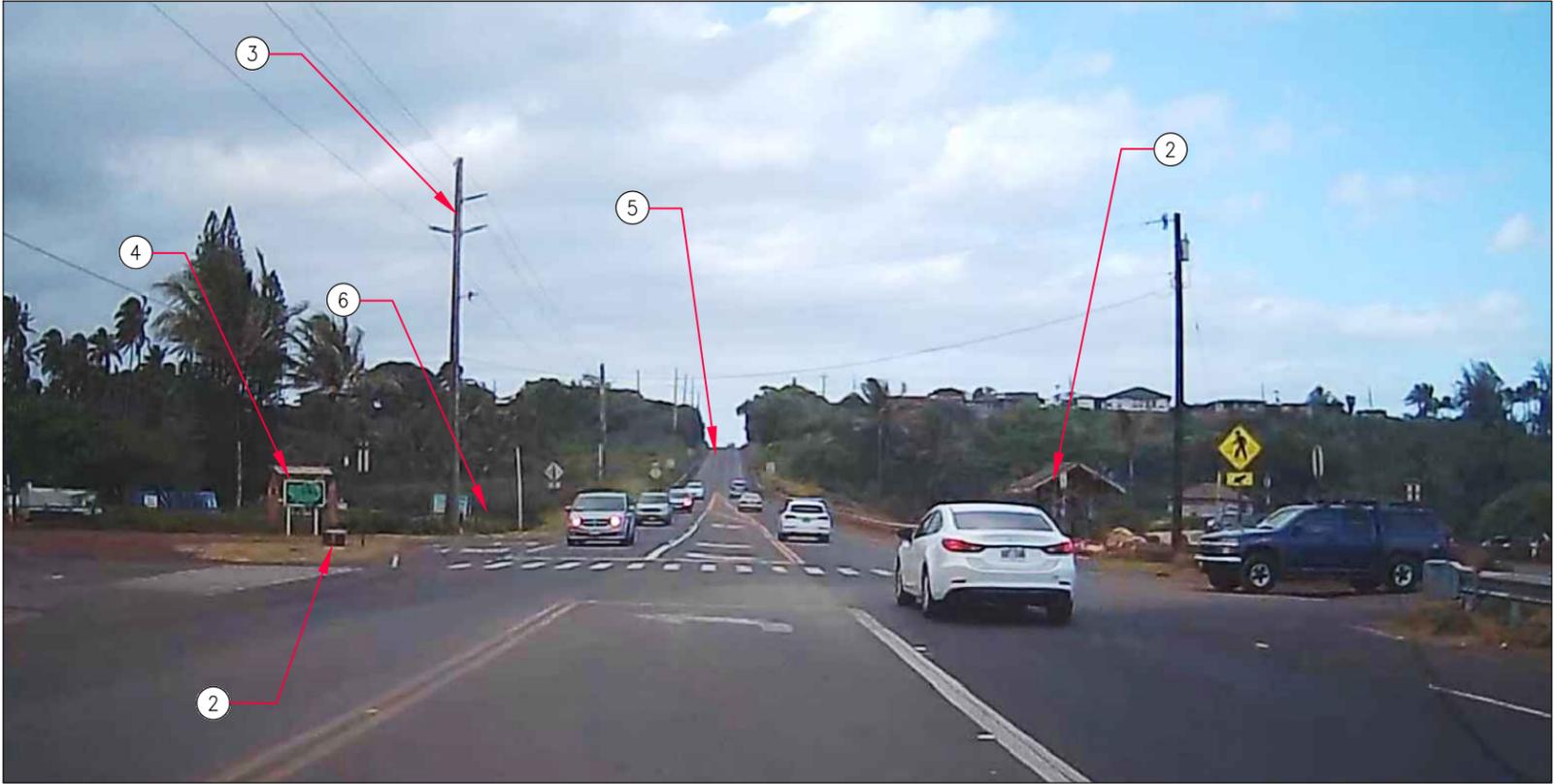
MAY 9, 2019

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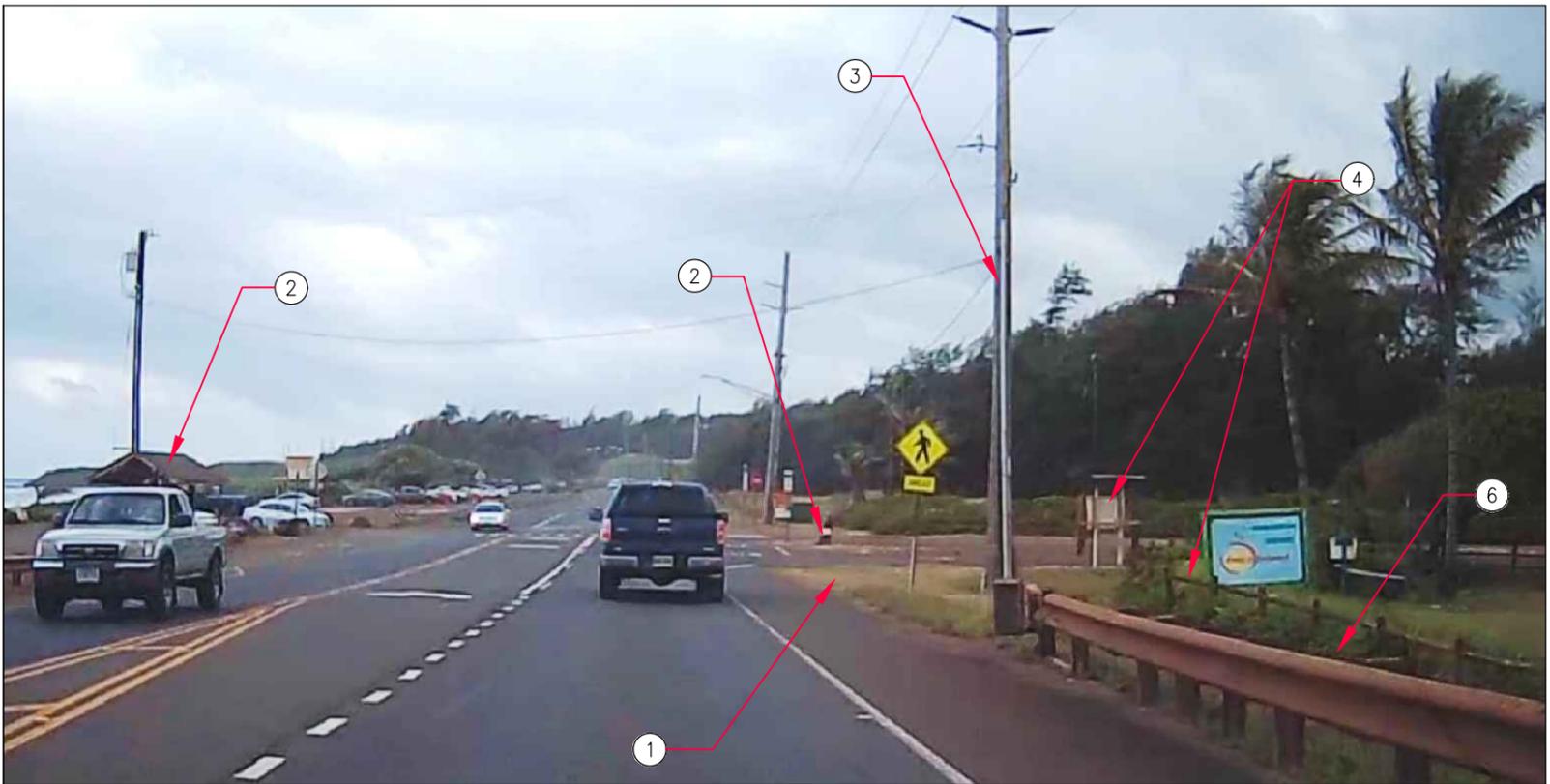
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ENGINEERS, SURVEYORS HONOLULU, HAWAII

KUHIO HIGHWAY AND KEALIA ROAD MITIGATION -
ROUNDBOUT

FIGURE
5.8



KUHIO HIGHWAY NORTHBOUND AT KEALIA ROAD



KUHIO HIGHWAY SOUTHBOUND AT KEALIA ROAD

LEGEND

- ① SB RT BYPASS LANE REQUIRED DUE TO ACUTE ANGLE BETWEEN KEALIA RD AND KUHIO HWY
- ② BUS STOP/SHELTER RELOCATION
- ③ ELECTRICAL UTILITY POLE RELOCATION
- ④ RECONSTRUCTION OF KEALIA SURF SHACK SIGNS AND FENCES
- ⑤ DESIGN ENHANCEMENTS TO REDUCE SPEED UPSTREAM OF ROUNDABOUT DUE TO STEEP DOWNHILL SB SLOPE
- ⑥ REGRADING OF AREAS MAUKA OF KUHIO HWY DUE TO STEEP SLOPE

6. CONCLUSIONS

The Project proposes to develop 235 single-family dwellings in the Kealia area. Access to the Project will be provided via Kealia Road from Kuhio Highway. The Project will construct a new four-way, one-lane roundabout north of the Kealia Road/Hopoe Road intersection to connect Kealia Road to the Project site. Both the southern and western approaches of the roundabout will have connections to Kealia Road. Although there is currently a direct access to Kuhio Highway along the Makai side of the Project site, this access will be fully removed during Project construction. Construction and occupancy of homes in the proposed subdivision is anticipated in 2027.

At full buildout, the Project is projected to generate a total of 172(231) net external trips during the AM(PM) peak hour of traffic.

6.1 Existing Conditions

Kuhio Highway serves as the main thoroughfare for regional traffic in East Kauai. On Monday through Saturday from 7:00 AM to 1:30 PM, Kuhio Highway is contraflowed to provide two (2) southbound lanes and one (1) northbound lane from the Kapaa Bypass south junction to Kapule Highway to serve heavier southbound volumes.

During the AM and PM peak hours of traffic, volumes along Kuhio Highway are generally balanced in both the northbound and southbound directions. During the AM peak hour, southbound traffic is generally higher. However, with approximately one-third of the AM southbound traffic utilizing Kapaa Bypass Road, the traffic volumes along Kuhio Highway are generally balanced during both the AM and PM peaks.

Within the region, queuing along southbound Kuhio Highway was observed to occur during the PM peak hour when contraflow operations were not in place. The queues generally extended approximately 1.25 miles from Kuamoo Road to near Kamoia Road. Occasionally, queues were observed to also form along southbound Kapaa Bypass Road during the PM peak hour. These queues extended approximately 0.4 miles from Kuhio Highway to Pouli Road.

Within Kapaa Town, queuing was observed during both the AM and PM peak hours of traffic. Queues began near the Kuhio Highway/Kawaihau Road intersection and extended in both the northbound and southbound directions. During both peak hours, southbound queues extended to Fire Station 8 (approximately 0.5 miles), and northbound queues extended to Kukui Street (approximately 0.55 miles). Queuing during the AM peak hour was mainly the result of traffic from the nearby Kapaa High School and Kapaa Elementary School.

Several of the study intersections movements operate at LOS F and/or overcapacity during the peak hours of traffic. Eastbound turning movements at Kuhio Highway/Mailihuna Road, Kuhio Highway/Kawaihau Road, Kuhio Highway/Hauaala Road and Kuhio Highway/Lehua Street as well as the eastbound approach of the Kapaa Bypass Road/Cane Haul Road/Olohena Road roundabout experienced lengthy delays due to high turning volumes.

6.2 Base Year 2027

It is anticipated that by Year 2027, traffic will have increased over existing conditions due to various anticipated new developments in the region shown in Figure 4.1. In addition to background development traffic, a 1% annual growth rate was applied to Kuhio Highway, Cane



Haul Road and Olohena Road and a 2% annual growth rate was applied to Kukui Street. By Year 2027, it is assumed that a roundabout will be constructed at Kuhio Highway/Mailihuna Road as shown in Figure 4.2.

It is anticipated that by Base Year 2027, traffic along Kuhio Highway will have increased over existing conditions due to the development in the surrounding regions. Actual growth within the study region may vary based upon the approval process of the various projects.

Peak hour queuing along Kuhio Highway is expected to operate similarly to existing conditions. Although not expected to be completed by Year 2027, the planned widening of Kuhio Highway from Kapaa Bypass Road to Kuamoo Road would reduce queues along Kuhio Highway south of the study intersections. Queuing along Kuhio Highway near Kawaihau Road is expected to remain in Base Year 2027.

Because of continued queuing along Kuhio Highway in Kapaa Town, the northbound through/right-turn movement at the Kuhio Highway/Kukui Street intersection is expected to operate at overcapacity conditions. The overcapacity conditions are expected to result from the increase in traffic volumes and slow northbound progression through Kapaa.

Many minor street movements are expected to experience increases in delay due to the increase in traffic along Kuhio Highway. However, the Kuhio Highway/Mailihuna Rd intersection is expected to operate with all movements at LOS C or better with the construction of the planned roundabout. Note that this LOS reflects conditions where drivers are accustomed to the movements through the roundabout. Initial traffic operations at the roundabout may result in longer delays as drivers become familiar with the maneuvers. Additionally, operations at the Kapaa Bypass Road/Cane Haul Road/Olohena Road roundabout are also expected to improve with the diversion of a portion of traffic through the proposed Hokua Place development.

Eastbound turning movements at Kuhio Highway/Kawaihau Road, Kuhio Highway/Hauaala Road and Kuhio Highway/Lehua Street will continue to experience lengthy delays due to high turning volumes.

6.3 Base Year 2027 With Mitigation

In order to improve Base Year 2027 traffic operations at the study intersections, the Kapaa Bypass Road extension and the relocation of the Hauaala Road connection are the preferred mitigations. Although the Kapaa Bypass Road extension is currently planned by HDOT, the project is not expected to be completed by Year 2027. Base Year 2027 mitigations are proposed for scenarios with and without the bypass extension included.

6.3.1 Base Year 2027 With Mitigation With Kapaa Bypass Road Extension

Kapaa Bypass Road Extension

The Kapaa Bypass Road extension from Olohena Road to Kuhio Highway would add a northbound lane to the existing one-way Cane Haul Road. With the extension, vehicles will be able to head farther north on the bypass road, and the left-turns from Lehua Street onto Kuhio Highway are expected to decrease. The extension has been identified as a proposed roadway improvement in the 2015 Kapaa Transportation Solutions report and has been acknowledged as a planned improvement by HDOT. With the extension, improvements will also be completed at the northern terminus. However, these improvements are currently not identified.



Hauaala Road Connection

With the Kapaa Bypass Road extension, the existing Hauaala Road connection to Kuhio Highway can be eliminated and replaced with a new connection from Hauaala Road to the Kapaa Bypass Road. Moving the Hauaala Road connection is expected to relieve congestion in the vicinity of the existing Kuhio Highway/Hauaala Road intersection by reducing the number of conflicting turning movements and providing a longer northbound left-turn pocket at the nearby Kuhio Highway/Kawaihau Road intersection. It was assumed that the proposed Kapaa Bypass Road/Hauaala Road intersection will have a stop-controlled left-/right-turn movement on Hauaala Road and shared eastbound left-turn/through and westbound through/right-turn movements on Kapaa Bypass Road. Relocating the Hauaala Road connection has been identified as a proposed roadway improvement in the 2015 Kapaa Transportation Solutions report.

With the above mitigations, traffic operations at Kuhio Highway/Kawaihau Road and Kuhio Highway/Lehua Street are expected to improve due to a decrease in turning movements. The new Kapaa Bypass Road/Hauaala Road and Kuhio Highway/Kapaa Bypass Road intersections are expected to operate with minor street movements at LOS E or F. However, all movements will operate under capacity and are anticipated to operate adequately.

6.3.2 Base Year 2027 With Mitigation Without Kapaa Bypass Road Extension

Although a traffic signal is warranted at Kuhio Highway/Lehua Street, a signal may not yield any significant benefits because of existing northbound queues along Kuhio Highway and because vehicles currently allow major street left-turns and minor street movements to proceed during congested periods and adequate gaps in traffic were observed during non-peak hours. Other improvements from the Kapaa Transportation Solutions report may be more appropriate:

- Closing the east leg of Kukui Street to allocate more green time to movements on Kuhio Highway.
- Improving the Kuhio Highway/Niu Street intersection to alleviate congestion at the Kuhio Highway/Lehua Street intersection.

Although not specified in the Kapaa Transportation Solutions report, improving the Kuhio Highway/Niu Street intersection likely consists of providing, similar to the Lehua Street intersection, a northbound refuge lane for eastbound left-turns.

By year 2027 signals may be warranted at the intersections of Kuhio Highway with Kawaihau Road and Hauaala Road. Analysis of traffic signals at these intersections would not provide accurate results as the analysis doesn't take into account the close proximity of the intersections. Based on observations, with a traffic signal, queues are expected to lengthen in the northbound direction due to the delays caused by a signal, the short northbound storage length and the fact that vehicles along Kuhio Highway would be less likely to yield to the minor movements when a signal is installed. Currently, without a signal, vehicles in the southbound through yield to the eastbound approach at a rate of approximately one (1) to two (2) eastbound vehicles to four (4) southbound through; therefore, it is anticipated that this type of behavior would continue. Furthermore, improvements at the Kuhio Highway/Mailihuna Road intersection may provide some relief at the Kawaihau Road and Hauaala Road intersections. Additionally, community input may be a factor in determining the viability of the improvement.



With the above mitigations, a portion of vehicles currently accessing Kuhio Highway via the Kuhio Highway/Lehua Street intersection are expected to access the highway at either Kuhio Highway/Niu Street or Kuhio Highway/Kukui Street in order to minimize delays. Although the eastbound approaches of all three (3) intersections are expected to operate at LOS F, all will operate at under capacity conditions. The northbound through/right-turn movement at Kuhio Highway/Kukui Street is expected to continue operating at overcapacity conditions.

6.4 Future Year 2027

At full buildout, the Project is projected to generate a total of 172(231) net external trips during the AM(PM) peak hour of traffic. Traffic from the Project is expected to generate growth along major roadways in the study area.

6.4.1 Future Year 2027 With Kapaa Bypass Road Extension

Similar to Base Year 2027, queuing along Kuhio Highway is expected to remain south of the study intersections until the widening of the roadway is completed. However, with Base Year 2027 mitigations, a decrease in queuing is expected in Kapaa town with the extension of the Kapaa Bypass Road and relocation of the Hauaala Road connection. Although queuing is expected to remain due to the high volume of turning movements in the area, queues will likely be reduced due to the diversion of traffic to Kapaa Bypass Road.

The majority of study intersections are forecast to experience increases in delay over Base Year 2027. However, all movements are expected to operate under capacity with minor street and major left-turn movements operating adequately due to the self-regulating behavior observed in existing conditions.

Because Kuhio Highway/Kealia Road is the only access point to the Project from Kuhio Highway, the intersection is expected to experience a significant increase in traffic. During both peak hours of traffic, the eastbound approach is expected to worsen to LOS F and overcapacity conditions. The westbound approach is also expected to operate at overcapacity conditions during the PM peak hour.

6.4.2 Future Year 2027 Without Kapaa Bypass Road Extension

Similar to Base Year 2027, queuing along Kuhio Highway within and south of the Project area is expected to remain until congestion relief projects are completed in Kapaa and Wailua. While major through movements are expected to continue allowing other movements to proceed during congested periods to reduce major left-turn and minor movement delay, all movements are expected to experience longer delays over existing conditions.

The majority of study intersections are forecast to experience increases in delay over Base Year 2027. The eastbound approaches of Kuhio Highway/Mailihuna Road, Kuhio Highway/Kawaihau Road and Kuhio Highway/Hauaala Road are expected to operate at LOS E/F and/or overcapacity conditions during the AM and PM peak hours with the increase in traffic along Kuhio Highway. Although these movements are expected to experience an increase in delay, the intersections are expected to operate similar to existing conditions with major through movements allowing other movements to proceed during congested periods. The eastbound approaches of Kuhio Highway/Lehua Street, Kuhio Highway/Niu Street and Kuhio Highway/Kukui Street are expected to continue operating at LOS F but under capacity as in Base Year 2027.



Northbound Kuhio Highway is anticipated to continue to operate at overcapacity conditions during both peak hours of traffic due to a lack of feasible alternatives to increase highway capacity in the area.

Because Kuhio Highway/Kealia Road is the only access point to the Project from Kuhio Highway, the intersection is expected to experience a significant increase in traffic. During both peak hours of traffic, the eastbound approach is expected to worsen to LOS F and overcapacity conditions. The westbound approach is also expected to operate at overcapacity conditions during the PM peak hour.

6.5 Future Year 2027 With Mitigation

For both the with Kapaa Bypass Road extension and without Kapaa Bypass Road extension scenarios, the following mitigations were considered at the Kuhio Highway/Kealia Road intersection to improve traffic operations.

- Install a traffic signal
- Construct a roundabout

Either a traffic signal or roundabout is expected to provide adequate mitigation at the Kuhio Highway/Kealia Road intersection for vehicular, bicycle and pedestrian traffic. For the purposes of this report, a roundabout was assumed to be the preferred alternative as the County of Kauai has previously indicated preference of a roundabout over a traffic signal at the intersection. However, it should be noted that a traffic signal would also provide adequate mitigation and may be considered if agreeable to the developer, County, State and other community groups.

Anticipated mitigation measures required as part of the roundabout are as follows. It should be noted that the proposed mitigation is based off of the single conceptual roundabout design evaluated as part of this study. Actual improvements required will depend on the final roundabout design.

[2] Kuhio Highway/Kealia Road

- Construct a single-lane, three-leg roundabout.
 - Realign the skewed eastbound approach of Kealia Road.
 - Realign the northbound approach of Kuhio Highway.
 - Provide a southbound right-turn bypass onto Kealia Road prior to the roundabout.
 - Relocate the existing northbound and southbound bus stops/bus bays along Kealia Road to south of the intersection.
 - Relocate electrical utility poles.
 - Reconstruct the Kealia Surf Shack signs and fences at the northwest corner of the intersection.
 - Provide crosswalks along all three (3) approaches.

With the proposed mitigation, all approaches will operate at LOS D or better during both peak hours of traffic. Additionally, the intersection will operate with overall LOS B/C during the AM/PM peak hours.



6.6 Future Year 2027 Sustainable Transportation

The Project proposes to construct improvements along Kealia Road in the vicinity of the Project, including the addition of a sidewalk providing access between the Project and Kuhio Highway. The proposed roadway cross section includes widening the existing right-of-way (ROW) from 40 feet to 56 feet to provide two (2) 10-foot vehicular travel lanes, 5-foot paved shoulders on each side of the roadway, a 5-foot wide concrete sidewalk and green space between the paved road shoulder and sidewalk. The paved shoulder may be utilized by bicyclists who are uncomfortable using the vehicular travel lane.

In addition to the planned improvements along Kealia Road, the construction of a roundabout at the Kuhio Highway/Kealia Road intersection will provide shorter crossing distances with median refuges along all approaches. A roundabout may also help to reduce speeds along the highway, although additional design enhancements may be necessary to encourage speed reductions. The existing bus stops at the intersection will continue to be provided, however, the existing bus bays for the northbound and southbound approaches of Kuhio Highway will be relocated just south of the intersection.

With the proposed improvements, pedestrian and bicycle traffic will be able to access bus stops and the Ke Ala Hele Makalae Multi-Use Path, which will allow them to travel further north and south of the Project area. Pedestrians and cyclists will also be able to access nearby residential areas and schools from the multi-use path via the Kawaihau Road spur or via the Mailihuna Road connection proposed with the construction of the roundabout.



7. RECOMMENDATIONS

7.1 Base Year 2027

The following roadway improvement was assumed to be completed by Base Year 2027:

- Construct a roundabout at the Kuhio Highway/Mailihuna Road intersection

7.2 Base Year 2027 With Mitigation

The following mitigations were proposed for Base Year 2027 for scenarios with and without the Kapaa Bypass Road extension.

7.2.1 Base Year 2027 With Mitigation With Kapaa Bypass Road Extension

Kapaa Bypass Road Extension

The Kapaa Bypass Road extension from Olohena Road to Kuhio Highway would add a northbound lane to the existing one-way Cane Haul Road. With the extension, vehicles will be able to head farther north on the bypass road, and the left-turns from Lehua Street onto Kuhio Highway are expected to decrease. The extension has been identified as a proposed roadway improvement in the 2015 Kapaa Transportation Solutions report and has been acknowledged as a planned improvement by HDOT. With the extension, improvements will also be completed at the northern terminus. However, these improvements are currently not identified.

Hauaala Road Connection

With the Kapaa Bypass Road extension, the existing Hauaala Road connection to Kuhio Highway can be eliminated and replaced with a new connection from Hauaala Road to the Kapaa Bypass Road. Moving the Hauaala Road connection is expected to relieve congestion in the vicinity of the existing Kuhio Highway/Hauaala Road intersection by reducing the number of conflicting turning movements and providing a longer northbound left-turn pocket at the nearby Kuhio Highway/Kawaihau Road intersection. It was assumed that the proposed Kapaa Bypass Road/Hauaala Road intersection will have a stop-controlled left/right-turn movement on Hauaala Road and shared eastbound left-turn/through and westbound through/right-turn movements on Kapaa Bypass Road. Relocating the Hauaala Road connection has been identified as a proposed roadway improvement in the 2015 Kapaa Transportation Solutions report.

7.2.2 Base Year 2027 With Mitigation Without Kapaa Bypass Road Extension

As proposed in the Kapaa Transportation Solutions report:

- Closing the east leg of Kukui Street to allocate more green time to movements on Kuhio Highway.
- Improving the Kuhio Highway/Niu Street intersection to alleviate congestion at the Kuhio Highway/Lehua Street intersection.
 - Although not specified in the Kapaa Transportation Solutions report, improving the Kuhio Highway/Niu Street intersection likely consists of providing, similar to the Lehua Street intersection, a northbound refuge lane for eastbound left-turns.



7.3 Future Year 2027 With Mitigation

The following mitigation is proposed for Future Year 2027 for both scenarios with and without the Kapaa Bypass Road extension.

[2] Kuhio Highway/Kealia Road

- Construct a single-lane, three-leg roundabout.
 - Realign the skewed eastbound approach of Kealia Road.
 - Realign the northbound approach of Kuhio Highway.
 - Provide a southbound right-turn bypass onto Kealia Road prior to the roundabout.
 - Relocate the existing northbound and southbound bus stops/bus bays along Kealia Road to south of the intersection.
 - Relocate electrical utility poles.
 - Reconstruct the Kealia Surf Shack signs and fences at the northwest corner of the intersection.
 - Provide crosswalks along all three (3) approaches.



8. REFERENCES

1. American Association of State Highway and Transportation Officials, A Policy on Geometric Design of Highways and Streets, 2011.
2. Federal Highway Administration, Manual on Uniform Traffic Control Devices, 2009.
3. Institute of Transportation Engineers, Trip Generation, 10th Edition, 2017.
4. State of Hawaii, Department of Transportation, Final Environmental Assessment Kapaa Stream Bridge, Kuhio Highway, and Mailihuna Road Intersection Project Kawaihau District, Island of Kauai, Hawaii, 2017.
5. State of Hawaii, Department of Transportation, Kapaa Transportation Solutions, 2015.
6. Transportation Research Board, Highway Capacity Manual, 6th Edition, 2016.



APPENDICES



APPENDIX A

TRAFFIC COUNT DATA

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File Name : AM_Kealia Rd - Kaa Rd

Site Code : 17-035 Kealia Residential Subdivision

Start Date : 4/19/2017

Page No : 1

Groups Printed- Motorcycles - Cars - Light Goods Vehicles - Buses - Unit Trucks - Articulated Trucks - Bicycles on Road - Bicycles on Crosswalk - Pedestrians

Start Time	KEALIA RD Southbound			KAAO RD Westbound			KEALIA RD Northbound				Int. Total
	Thru	Left	Peds	Right	Left	Peds	Right	Thru	Left	Peds	
07:15	1	0	0	0	4	0	1	1	0	0	7
07:30	2	1	0	2	4	0	2	0	0	1	12
07:45	3	0	0	0	6	0	8	1	0	0	18
Total	6	1	0	2	14	0	11	2	0	1	37
08:00	2	1	0	1	3	0	2	1	0	0	10
Grand Total	8	2	0	3	17	0	13	3	0	1	47
Apprch %	80	20	0	15	85	0	76.5	17.6	0	5.9	
Total %	17	4.3	0	6.4	36.2	0	27.7	6.4	0	2.1	
Motorcycles	0	0	0	0	0	0	0	0	0	0	0
% Motorcycles	0	0	0	0	0	0	0	0	0	0	0
Cars	4	2	0	3	10	0	8	2	0	0	29
% Cars	50	100	0	100	58.8	0	61.5	66.7	0	0	61.7
Light Goods Vehicles	4	0	0	0	7	0	4	1	0	0	16
% Light Goods Vehicles	50	0	0	0	41.2	0	30.8	33.3	0	0	34
Buses	0	0	0	0	0	0	1	0	0	0	1
% Buses	0	0	0	0	0	0	7.7	0	0	0	2.1
Single-Unit Trucks	0	0	0	0	0	0	0	0	0	0	0
% Single-Unit Trucks	0	0	0	0	0	0	0	0	0	0	0
Articulated Trucks	0	0	0	0	0	0	0	0	0	0	0
% Articulated Trucks	0	0	0	0	0	0	0	0	0	0	0
Bicycles on Road	0	0	0	0	0	0	0	0	0	0	0
% Bicycles on Road	0	0	0	0	0	0	0	0	0	0	0
Bicycles on Crosswalk	0	0	0	0	0	0	0	0	0	0	0
% Bicycles on Crosswalk	0	0	0	0	0	0	0	0	0	0	0
Pedestrians	0	0	0	0	0	0	0	0	0	1	1
% Pedestrians	0	0	0	0	0	0	0	0	0	100	2.1

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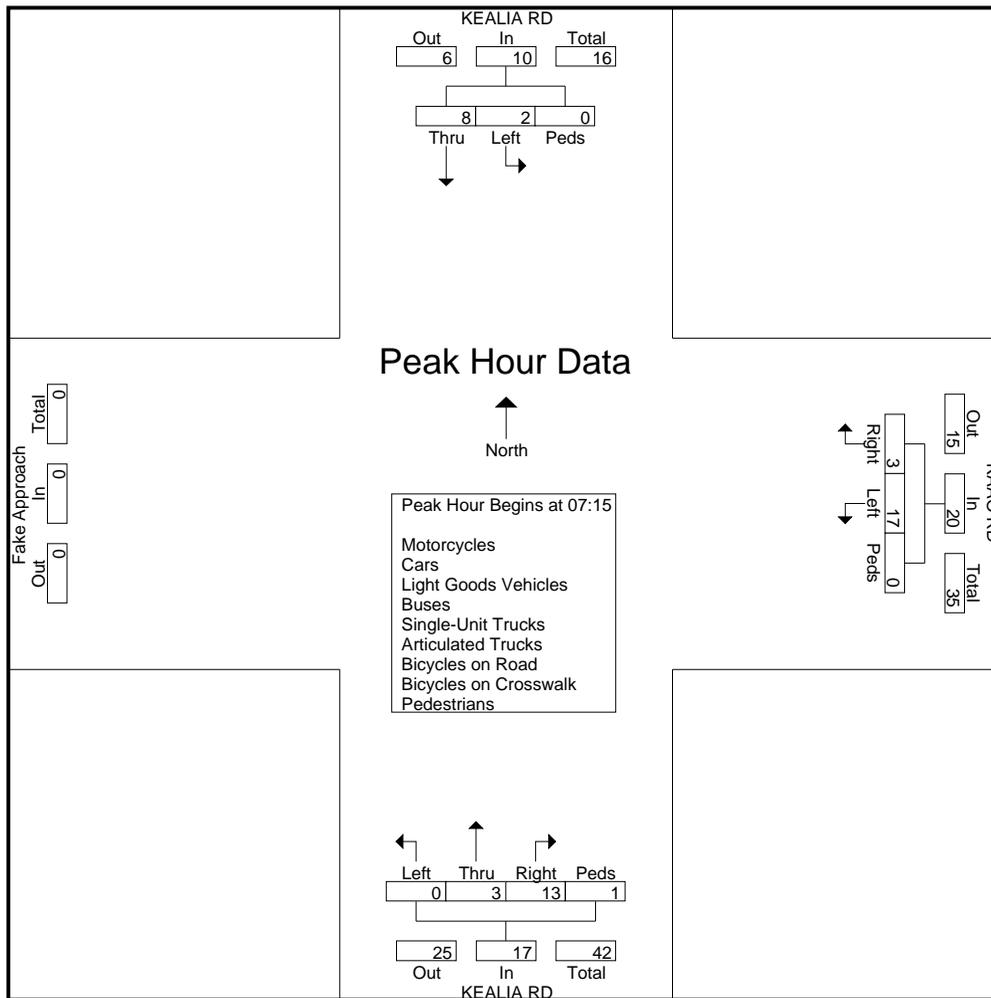
File Name : AM_Kealia Rd - KaaO Rd

Site Code : 17-035 Kealia Residential Subdivision

Start Date : 4/19/2017

Page No : 2

Start Time	KEALIA RD Southbound				KAAO RD Westbound				KEALIA RD Northbound					Int. Total
	Thru	Left	Peds	App. Total	Right	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	
Peak Hour Analysis From 07:15 to 08:00 - Peak 1 of 1														
Peak Hour for Entire Intersection Begins at 07:15														
07:15	1	0	0	1	0	4	0	4	1	1	0	0	2	7
07:30	2	1	0	3	2	4	0	6	2	0	0	1	3	12
07:45	3	0	0	3	0	6	0	6	8	1	0	0	9	18
08:00	2	1	0	3	1	3	0	4	2	1	0	0	3	10
Total Volume	8	2	0	10	3	17	0	20	13	3	0	1	17	47
% App. Total	80	20	0		15	85	0		76.5	17.6	0	5.9		
PHF	.667	.500	.000	.833	.375	.708	.000	.833	.406	.750	.000	.250	.472	.653



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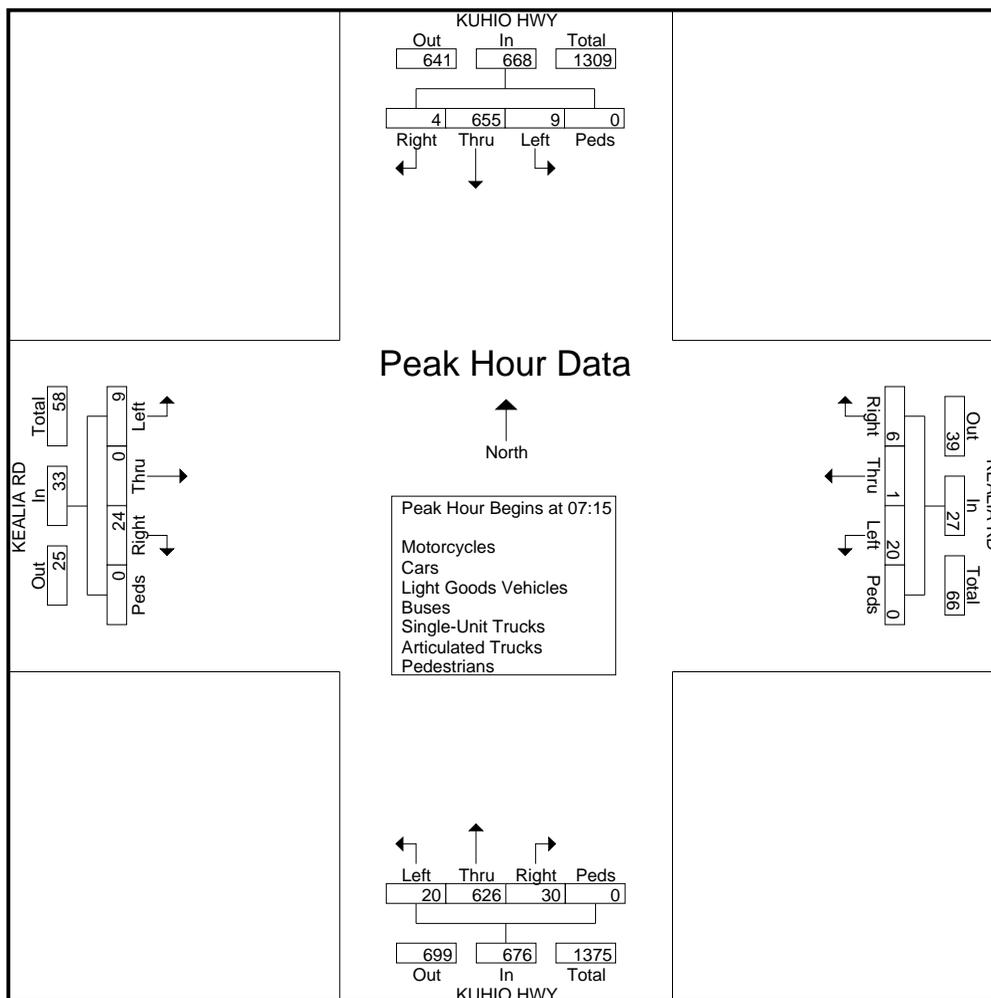
File Name : AM_Kuhio Hwy - Kealia Rd

Site Code : 17-035 Kealia Residential Subdivision

Start Date : 4/19/2017

Page No : 2

Start Time	KUHIO HWY Southbound					KEALIA RD Westbound					KUHIO HWY Northbound					KEALIA RD Eastbound					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 06:30 to 08:15 - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:15																					
07:15	1	168	2	0	171	2	0	3	0	5	5	162	3	0	170	5	0	5	0	10	356
07:30	0	176	1	0	177	0	0	8	0	8	4	158	3	0	165	7	0	1	0	8	358
07:45	0	173	4	0	177	3	1	2	0	6	14	153	11	0	178	6	0	0	0	6	367
08:00	3	138	2	0	143	1	0	7	0	8	7	153	3	0	163	6	0	3	0	9	323
Total Volume	4	655	9	0	668	6	1	20	0	27	30	626	20	0	676	24	0	9	0	33	1404
% App. Total	0.6	98.1	1.3	0		22.2	3.7	74.1	0		4.4	92.6	3	0		72.7	0	27.3	0		
PHF	.333	.930	.563	.000	.944	.500	.250	.625	.000	.844	.536	.966	.455	.000	.949	.857	.000	.450	.000	.825	.956



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File Name : AM_Kuhio Hwy - Mailihuna Rd

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Start Date : 4/19/2017

Page No : 1

Groups Printed- Unshifted

Start Time	KUHIO HWY Southbound				Westbound				KUHIO HWY Northbound				MAILIHUNA RD Eastbound				Int. Total
	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	
06:30	21	100	0	0	0	0	0	0	0	78	0	0	10	0	45	0	254
06:45	27	108	0	0	0	0	0	0	0	84	5	0	12	0	47	0	283
Total	48	208	0	0	0	0	0	0	0	162	5	0	22	0	92	0	537
07:00	21	125	0	0	0	0	0	0	0	98	11	0	13	0	44	0	312
07:15	31	134	0	0	0	0	0	0	0	106	9	0	18	0	71	0	369
07:30	42	149	0	0	0	0	0	0	0	116	24	0	11	0	56	0	398
07:45	49	130	0	0	0	0	0	0	0	120	38	0	22	0	58	0	417
Total	143	538	0	0	0	0	0	0	0	440	82	0	64	0	229	0	1496
08:00	41	121	0	0	0	0	0	0	0	117	25	0	27	0	49	0	380
08:15	17	115	0	0	0	0	0	0	0	115	10	0	10	0	36	0	303
Grand Total	249	982	0	0	0	0	0	0	0	834	122	0	123	0	406	0	2716
Apprch %	20.2	79.8	0	0	0	0	0	0	0	87.2	12.8	0	23.3	0	76.7	0	
Total %	9.2	36.2	0	0	0	0	0	0	0	30.7	4.5	0	4.5	0	14.9	0	

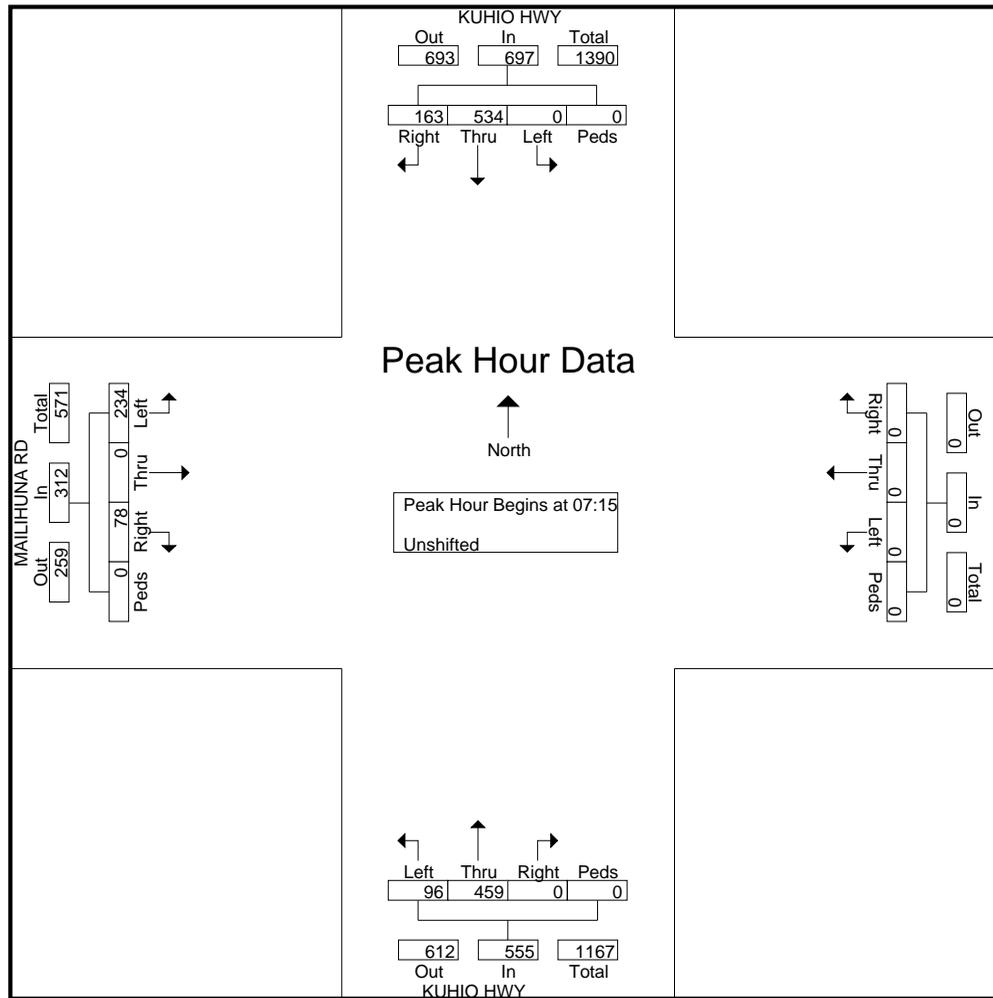
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File Name : AM_Kuhio Hwy - Mailihuna Rd
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Page No : 2

Start Time	KUHIO HWY Southbound					Westbound					KUHIO HWY Northbound					MAILIHUNA RD Eastbound					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 06:30 to 08:00 - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:15																					
07:15	31	134	0	0	165	0	0	0	0	0	0	106	9	0	115	18	0	71	0	89	369
07:30	42	149	0	0	191	0	0	0	0	0	0	116	24	0	140	11	0	56	0	67	398
07:45	49	130	0	0	179	0	0	0	0	0	0	120	38	0	158	22	0	58	0	80	417
08:00	41	121	0	0	162	0	0	0	0	0	0	117	25	0	142	27	0	49	0	76	380
Total Volume	163	534	0	0	697	0	0	0	0	0	0	459	96	0	555	78	0	234	0	312	1564
% App. Total	23.4	76.6	0	0		0	0	0	0	0	0	82.7	17.3	0		25	0	75	0		
PHF	.832	.896	.000	.000	.912	.000	.000	.000	.000	.000	.000	.956	.632	.000	.878	.722	.000	.824	.000	.876	.938



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Start Date : 4/19/2017

Page No : 1

Groups Printed- Unshifted

Start Time	KUHIO HWY Southbound				Westbound				KUHIO HWY Northbound				KAWAIHAU RD Eastbound				Int. Total
	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	
07:15	3	132	0	3	0	0	0	0	0	117	98	0	92	0	1	4	450
07:30	13	144	0	2	0	0	0	0	0	136	93	0	69	0	3	0	460
07:45	7	123	0	2	0	0	0	0	0	116	80	0	91	0	3	4	426
Total	23	399	0	7	0	0	0	0	0	369	271	0	252	0	7	8	1336
08:00	3	160	0	2	0	0	0	0	0	115	59	0	69	0	4	0	412
Grand Total	26	559	0	9	0	0	0	0	0	484	330	0	321	0	11	8	1748
Apprch %	4.4	94.1	0	1.5	0	0	0	0	0	59.5	40.5	0	94.4	0	3.2	2.4	
Total %	1.5	32	0	0.5	0	0	0	0	0	27.7	18.9	0	18.4	0	0.6	0.5	

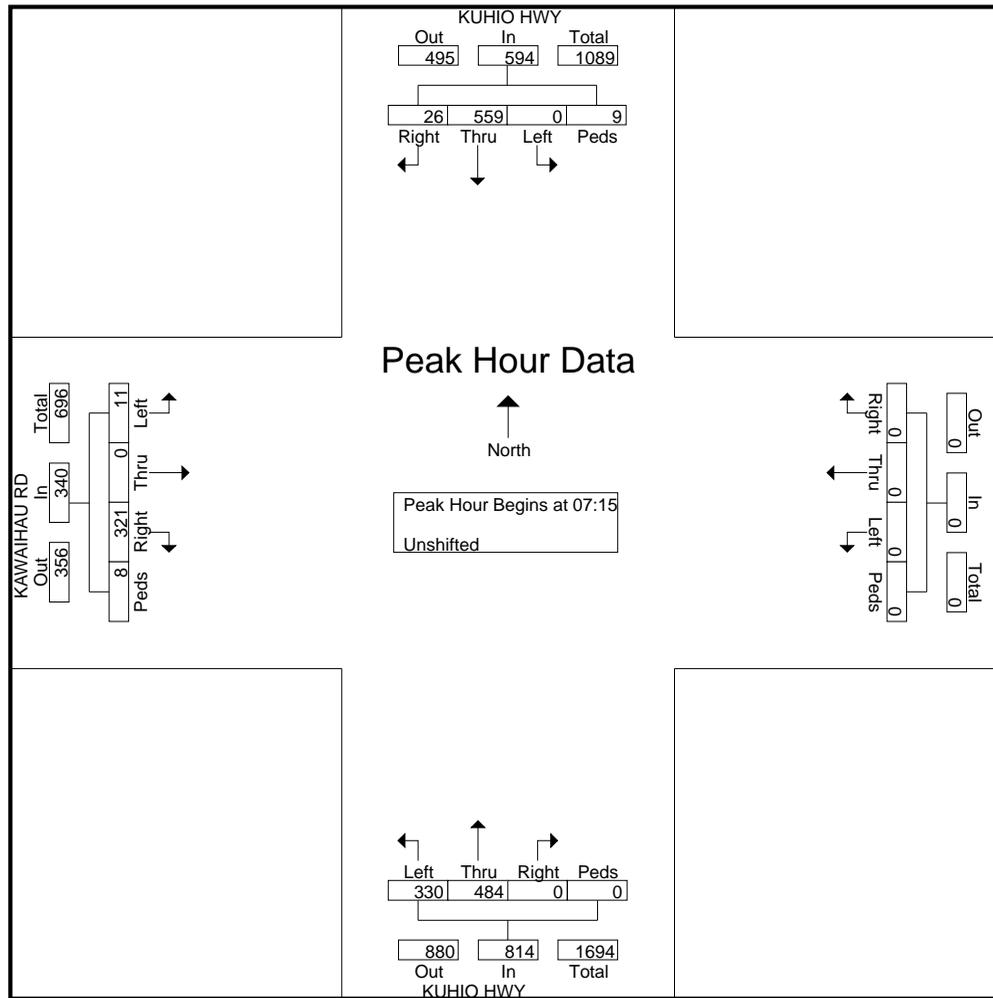
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File Name : AM_Kuhio Hwy - Kawaihau Rd
Site Code : 00000000
Start Date : 4/19/2017
Page No : 2

Start Time	KUHIO HWY Southbound					Westbound					KUHIO HWY Northbound					KAWAIHAU RD Eastbound					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 07:15 to 08:00 - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:15																					
07:15	3	132	0	3	138	0	0	0	0	0	0	117	98	0	215	92	0	1	4	97	450
07:30	13	144	0	2	159	0	0	0	0	0	0	136	93	0	229	69	0	3	0	72	460
07:45	7	123	0	2	132	0	0	0	0	0	0	116	80	0	196	91	0	3	4	98	426
08:00	3	160	0	2	165	0	0	0	0	0	0	115	59	0	174	69	0	4	0	73	412
Total Volume	26	559	0	9	594	0	0	0	0	0	0	484	330	0	814	321	0	11	8	340	1748
% App. Total	4.4	94.1	0	1.5		0	0	0	0		0	59.5	40.5	0		94.4	0	3.2	2.4		
PHF	.500	.873	.000	.750	.900	.000	.000	.000	.000	.000	.000	.890	.842	.000	.889	.872	.000	.688	.500	.867	.950



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Groups Printed- Unshifted

Start Time	KUHIO HWY SOUTHBOUND				HAUAALA RD WESTBOUND				KUHIO HWY NORTHBOUND				HAUAALA RD EASBOUND				Int. Total
	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	
06:30	1	152	0	2	0	0	0	0	0	127	12	0	65	0	1	0	360
06:45	0	180	0	6	0	0	0	0	0	144	9	0	77	0	0	2	418
Total	1	332	0	8	0	0	0	0	0	271	21	0	142	0	1	2	778
07:00	0	249	0	1	0	0	0	0	0	153	14	0	87	0	0	0	504
07:15	3	221	0	3	0	0	0	0	0	215	15	0	99	0	2	2	560
07:30	0	213	0	2	0	0	0	0	0	229	10	0	92	0	9	0	555
07:45	3	212	0	2	0	0	0	0	0	194	24	0	80	0	3	1	519
Total	6	895	0	8	0	0	0	0	0	791	63	0	358	0	14	3	2138
08:00	4	224	0	2	0	0	0	0	0	175	17	0	67	0	0	1	490
08:15	5	193	0	2	0	0	0	0	0	159	11	0	76	0	2	0	448
Grand Total	16	1644	0	20	0	0	0	0	0	1396	112	0	643	0	17	6	3854
Apprch %	1	97.9	0	1.2	0	0	0	0	0	92.6	7.4	0	96.5	0	2.6	0.9	
Total %	0.4	42.7	0	0.5	0	0	0	0	0	36.2	2.9	0	16.7	0	0.4	0.2	

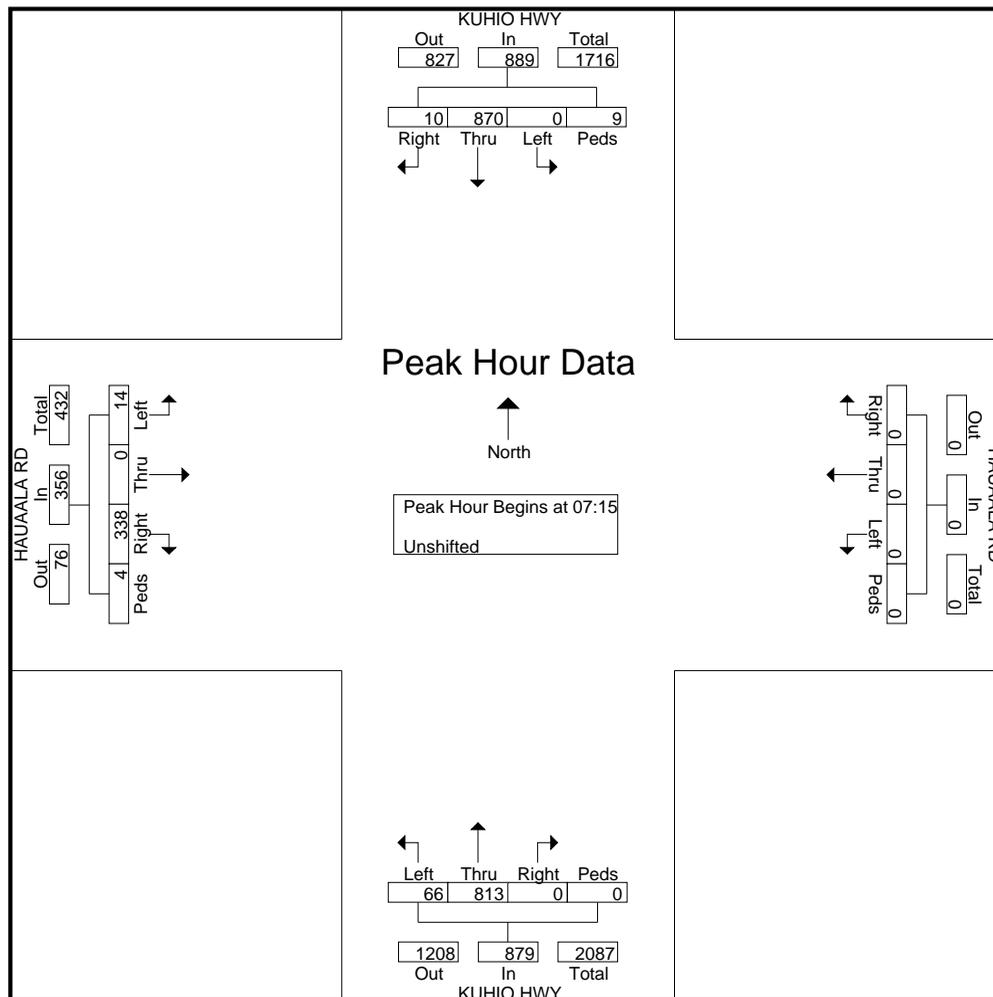
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File Name : AM_Kuhio Hwy - Hauaala Rd
Site Code : 00000000
Start Date : 4/19/2017
Page No : 2

Start Time	KUHIO HWY SOUTHBOUND					HAUAALA RD WESTBOUND					KUHIO HWY NORTHBOUND					HAUAALA RD EASBOUND					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 07:15 to 08:00 - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:15																					
07:15	3	221	0	3	227	0	0	0	0	0	0	215	15	0	230	99	0	2	2	103	560
07:30	0	213	0	2	215	0	0	0	0	0	0	229	10	0	239	92	0	9	0	101	555
07:45	3	212	0	2	217	0	0	0	0	0	0	194	24	0	218	80	0	3	1	84	519
08:00	4	224	0	2	230	0	0	0	0	0	0	175	17	0	192	67	0	0	1	68	490
Total Volume	10	870	0	9	889	0	0	0	0	0	0	813	66	0	879	338	0	14	4	356	2124
% App. Total	1.1	97.9	0	1		0	0	0	0		0	92.5	7.5	0		94.9	0	3.9	1.1		
PHF	.625	.971	.000	.750	.966	.000	.000	.000	.000	.000	.000	.888	.688	.000	.919	.854	.000	.389	.500	.864	.948



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File Name : AM_Kuhio Hwy - Cane Haul Rd

Site Code : 00000000

Start Date : 4/19/2017

Page No : 1

Groups Printed- Unshifted

Start Time	KUHIO HWY Southbound				Westbound				KUHIO HWY Northbound				CANE HAUL RD Eastbound				Int. Total	
	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds		
06:30	42	178	0	2	0	0	0	0	0	143	0	0	0	0	0	0	2	367
06:45	60	194	0	6	0	0	0	0	0	154	0	0	0	0	0	0	3	417
Total	102	372	0	8	0	0	0	0	0	297	0	0	0	0	0	0	5	784
07:00	98	236	0	1	0	0	0	0	0	177	0	0	0	0	0	0	1	513
07:15	101	205	0	3	0	0	0	0	0	223	3	0	0	0	0	0	3	538
07:30	104	208	0	2	0	0	0	0	0	254	3	0	0	0	0	0	1	572
07:45	102	210	0	2	0	0	0	0	0	252	3	0	0	0	0	0	0	569
Total	405	859	0	8	0	0	0	0	0	906	9	0	0	0	0	0	5	2192
08:00	94	216	0	2	0	0	0	0	0	206	8	0	0	0	0	0	0	526
08:15	103	203	0	2	0	0	0	0	0	174	4	0	0	0	0	0	0	486
Grand Total	704	1650	0	20	0	0	0	0	0	1583	21	0	0	0	0	0	10	3988
Apprch %	29.7	69.5	0	0.8	0	0	0	0	0	98.7	1.3	0	0	0	0	0	100	
Total %	17.7	41.4	0	0.5	0	0	0	0	0	39.7	0.5	0	0	0	0	0	0.3	

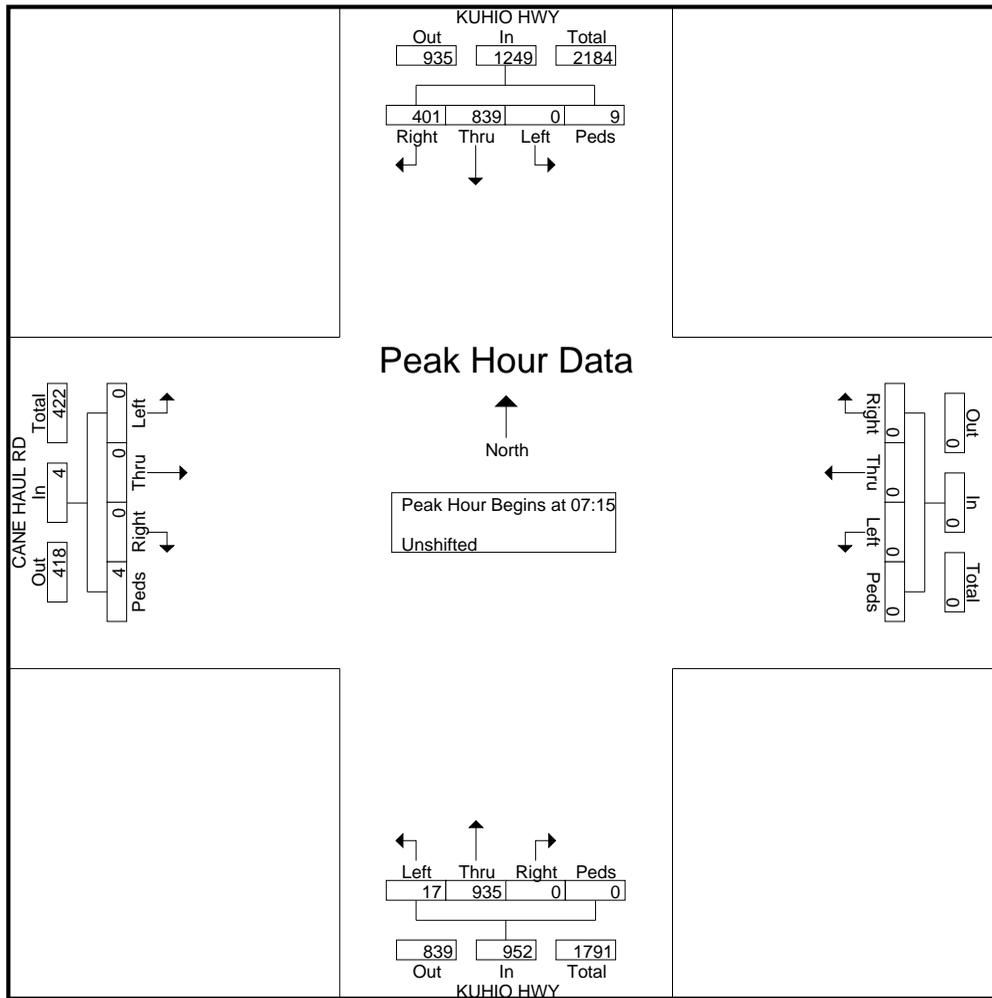
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File Name : AM_Kuhio Hwy - Cane Haul Rd
Site Code : 00000000
Start Date : 4/19/2017
Page No : 2

Start Time	KUHIO HWY Southbound					Westbound					KUHIO HWY Northbound					CANE HAUL RD Eastbound					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 06:30 to 08:15 - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:15																					
07:15	101	205	0	3	309	0	0	0	0	0	0	223	3	0	226	0	0	0	3	3	538
07:30	104	208	0	2	314	0	0	0	0	0	0	254	3	0	257	0	0	0	1	1	572
07:45	102	210	0	2	314	0	0	0	0	0	0	252	3	0	255	0	0	0	0	0	569
08:00	94	216	0	2	312	0	0	0	0	0	0	206	8	0	214	0	0	0	0	0	526
Total Volume	401	839	0	9	1249	0	0	0	0	0	0	935	17	0	952	0	0	0	4	4	2205
% App. Total	32.1	67.2	0	0.7		0	0	0	0	0	0	98.2	1.8	0		0	0	0	100		
PHF	.964	.971	.000	.750	.994	.000	.000	.000	.000	.000	.000	.920	.531	.000	.926	.000	.000	.000	.333	.333	.964



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File Name : AM_Kuhio Hwy - Lehua St

Site Code : 17-035 Kealia Residential Subdivision

Start Date : 4/19/2017

Page No : 1

Groups Printed- Motorcycles - Cars - Light Goods Vehicles - Buses - Unit Trucks - Articulated Trucks - Bicycles on Road - Bicycles on Crosswalk - Pedestrians

Start Time	KUHIO HWY Southbound			KUHIO HWY Northbound			LEHUA ST Eastbound			Int. Total
	Right	Thru	Peds	Thru	Left	Peds	Right	Left	Peds	
06:30	10	153	0	123	3	0	1	31	0	321
06:45	8	185	0	117	0	0	1	44	0	355
Total	18	338	0	240	3	0	2	75	0	676
07:00	12	219	0	131	0	0	2	55	2	421
07:15	17	195	0	168	0	0	1	80	1	462
07:30	14	179	0	176	1	0	4	87	3	464
07:45	20	183	0	183	1	0	3	77	0	467
Total	63	776	0	658	2	0	10	299	6	1814
08:00	20	183	0	174	2	0	2	41	1	423
08:15	18	188	0	159	3	0	1	44	2	415
Grand Total	119	1485	0	1231	10	0	15	459	9	3328
Apprch %	7.4	92.6	0	99.2	0.8	0	3.1	95	1.9	
Total %	3.6	44.6	0	37	0.3	0	0.5	13.8	0.3	
Motorcycles	0	4	0	2	0	0	0	2	0	8
% Motorcycles	0	0.3	0	0.2	0	0	0	0.4	0	0.2
Cars	67	978	0	744	9	0	12	297	0	2107
% Cars	56.3	65.9	0	60.4	90	0	80	64.7	0	63.3
Light Goods Vehicles	37	475	0	431	1	0	3	147	0	1094
% Light Goods Vehicles	31.1	32	0	35	10	0	20	32	0	32.9
Buses	15	11	0	18	0	0	0	10	0	54
% Buses	12.6	0.7	0	1.5	0	0	0	2.2	0	1.6
Single-Unit Trucks	0	13	0	34	0	0	0	3	0	50
% Single-Unit Trucks	0	0.9	0	2.8	0	0	0	0.7	0	1.5
Articulated Trucks	0	2	0	1	0	0	0	0	0	3
% Articulated Trucks	0	0.1	0	0.1	0	0	0	0	0	0.1
Bicycles on Road	0	2	0	1	0	0	0	0	0	3
% Bicycles on Road	0	0.1	0	0.1	0	0	0	0	0	0.1
Bicycles on Crosswalk	0	0	0	0	0	0	0	0	0	0
% Bicycles on Crosswalk	0	0	0	0	0	0	0	0	0	0
Pedestrians	0	0	0	0	0	0	0	0	9	9
% Pedestrians	0	0	0	0	0	0	0	0	100	0.3

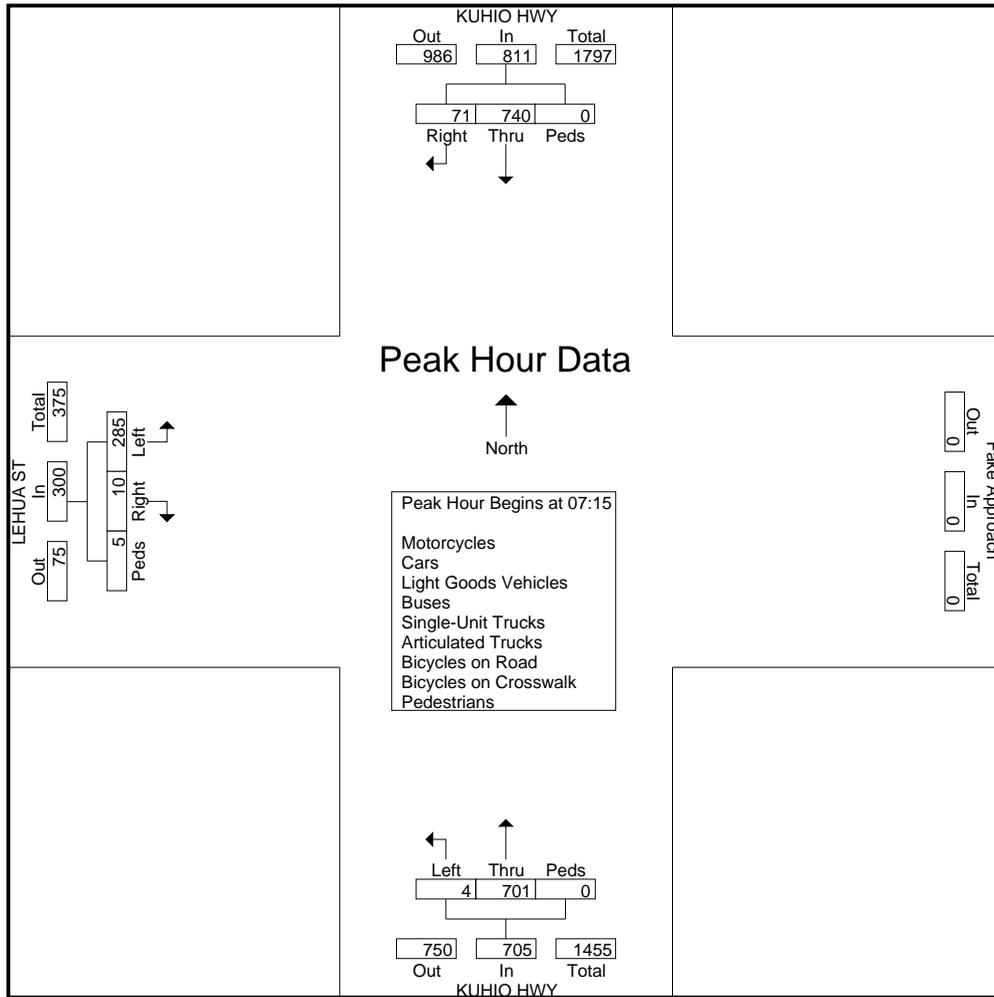
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File Name : AM_Kuhio Hwy - Lehua St
Site Code : 17-035 Kealia Residential Subdivision
Start Date : 4/19/2017
Page No : 2

Start Time	KUHIO HWY Southbound				KUHIO HWY Northbound				LEHUA ST Eastbound				Int. Total
	Right	Thru	Peds	App. Total	Thru	Left	Peds	App. Total	Right	Left	Peds	App. Total	
Peak Hour Analysis From 06:30 to 08:15 - Peak 1 of 1													
Peak Hour for Entire Intersection Begins at 07:15													
07:15	17	195	0	212	168	0	0	168	1	80	1	82	462
07:30	14	179	0	193	176	1	0	177	4	87	3	94	464
07:45	20	183	0	203	183	1	0	184	3	77	0	80	467
08:00	20	183	0	203	174	2	0	176	2	41	1	44	423
Total Volume	71	740	0	811	701	4	0	705	10	285	5	300	1816
% App. Total	8.8	91.2	0		99.4	0.6	0		3.3	95	1.7		
PHF	.888	.949	.000	.956	.958	.500	.000	.958	.625	.819	.417	.798	.972



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File Name : AM_Kuhio Hwy - Niu St

Site Code : 17-035 Kealia Residential Subdivision

Start Date : 4/19/2017

Page No : 1

Groups Printed- Motorcycles - Cars - Light Goods Vehicles - Buses - Unit Trucks - Articulated Trucks - Bicycles on Road - Bicycles on Crosswalk - Pedestrians

Start Time	KUHIO HWY Southbound				NIU ST Westbound				KUHIO HWY Northbound				NIU ST Eastbound				Int. Total
	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	
07:15	0	185	12	0	14	0	1	5	2	160	0	5	1	1	1	5	392
07:30	0	164	20	0	9	0	2	2	0	165	1	4	2	1	1	7	378
07:45	2	168	18	0	17	2	1	5	1	165	5	1	1	0	3	0	389
Total	2	517	50	0	40	2	4	12	3	490	6	10	4	2	5	12	1159
08:00	2	162	19	0	15	0	1	2	2	154	2	3	2	0	0	0	364
Grand Total	4	679	69	0	55	2	5	14	5	644	8	13	6	2	5	12	1523
Apprch %	0.5	90.3	9.2	0	72.4	2.6	6.6	18.4	0.7	96.1	1.2	1.9	24	8	20	48	
Total %	0.3	44.6	4.5	0	3.6	0.1	0.3	0.9	0.3	42.3	0.5	0.9	0.4	0.1	0.3	0.8	
Motorcycles	0	1	1	0	0	0	0	0	0	2	0	0	0	0	0	0	4
% Motorcycles	0	0.1	1.4	0	0	0	0	0	0	0.3	0	0	0	0	0	0	0.3
Cars	1	459	51	0	33	1	5	0	2	394	5	0	1	1	4	0	957
% Cars	25	67.6	73.9	0	60	50	100	0	40	61.2	62.5	0	16.7	50	80	0	62.8
Light Goods Vehicles	3	197	16	0	22	1	0	0	3	221	3	0	5	0	1	0	472
% Light Goods Vehicles	75	29	23.2	0	40	50	0	0	60	34.3	37.5	0	83.3	0	20	0	31
Buses	0	10	1	0	0	0	0	0	0	4	0	0	0	0	0	0	15
% Buses	0	1.5	1.4	0	0	0	0	0	0	0.6	0	0	0	0	0	0	1
Single-Unit Trucks	0	10	0	0	0	0	0	0	0	19	0	0	0	0	0	0	29
% Single-Unit Trucks	0	1.5	0	0	0	0	0	0	0	3	0	0	0	0	0	0	1.9
Articulated Trucks	0	1	0	0	0	0	0	0	0	3	0	0	0	0	0	0	4
% Articulated Trucks	0	0.1	0	0	0	0	0	0	0	0.5	0	0	0	0	0	0	0.3
Bicycles on Road	0	1	0	0	0	0	0	0	0	1	0	0	0	1	0	0	3
% Bicycles on Road	0	0.1	0	0	0	0	0	0	0	0.2	0	0	0	50	0	0	0.2
Bicycles on Crosswalk	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	1	3
% Bicycles on Crosswalk	0	0	0	0	0	0	0	0	0	0	0	15.4	0	0	0	8.3	0.2
Pedestrians	0	0	0	0	0	0	0	14	0	0	0	11	0	0	0	11	36
% Pedestrians	0	0	0	0	0	0	0	100	0	0	0	84.6	0	0	0	91.7	2.4

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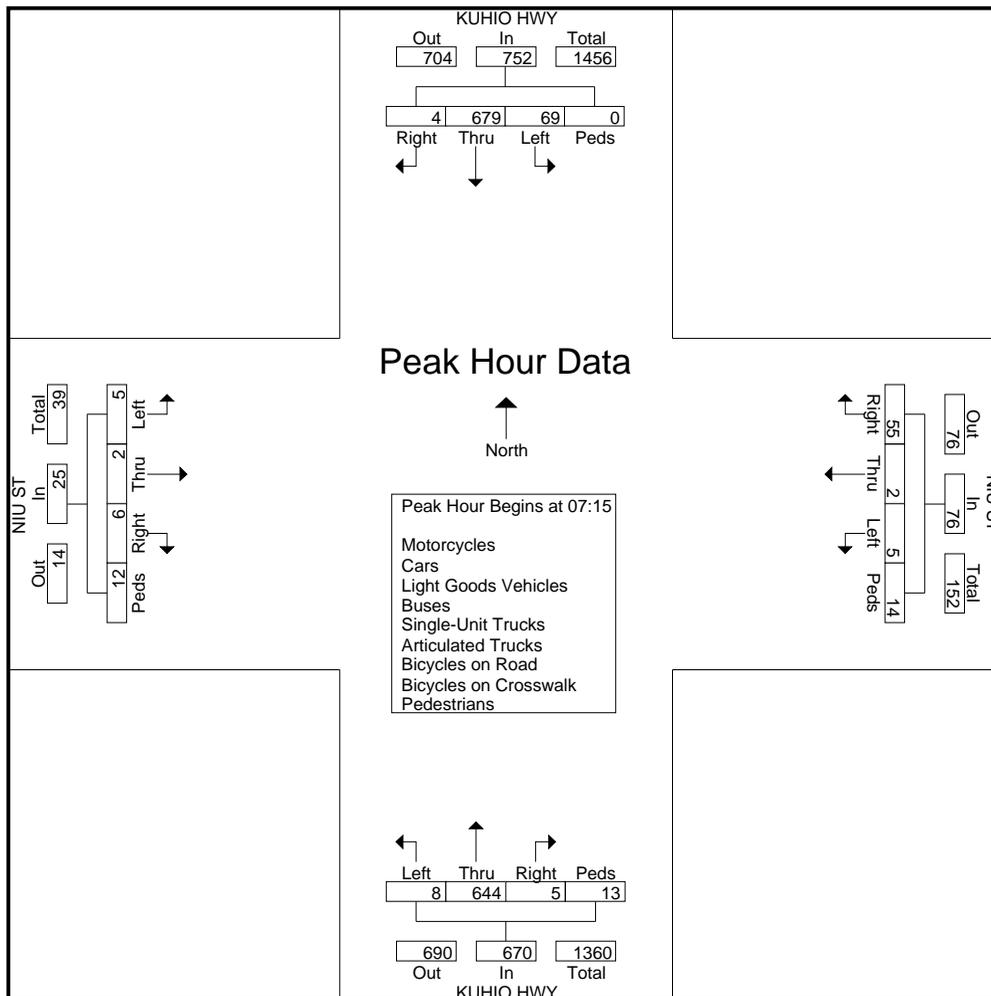
File Name : AM_Kuhio Hwy - Niu St

Site Code : 17-035 Kealia Residential Subdivision

Start Date : 4/19/2017

Page No : 2

Start Time	KUHIO HWY Southbound					NIU ST Westbound					KUHIO HWY Northbound					NIU ST Eastbound					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 07:15 to 08:00 - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:15																					
07:15	0	185	12	0	197	14	0	1	5	20	2	160	0	5	167	1	1	1	5	8	392
07:30	0	164	20	0	184	9	0	2	2	13	0	165	1	4	170	2	1	1	7	11	378
07:45	2	168	18	0	188	17	2	1	5	25	1	165	5	1	172	1	0	3	0	4	389
08:00	2	162	19	0	183	15	0	1	2	18	2	154	2	3	161	2	0	0	0	2	364
Total Volume	4	679	69	0	752	55	2	5	14	76	5	644	8	13	670	6	2	5	12	25	1523
% App. Total	0.5	90.3	9.2	0		72.4	2.6	6.6	18.4		0.7	96.1	1.2	1.9		24	8	20	48		
PHF	.500	.918	.863	.000	.954	.809	.250	.625	.700	.760	.625	.976	.400	.650	.974	.750	.500	.417	.429	.568	.971



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File Name : AM_Kuhio Hwy - Kukui_Huluili St

Site Code : 17-035

Start Date : 4/19/2017

Page No : 1

Groups Printed- Motorcycles - Cars - Light Goods Vehicles - Buses - Unit Trucks - Articulated Trucks - Bicycles on Road - Bicycles on Crosswalk - Pedestrians

Start Time	KUHIO HWY Southbound				KUKUI ST Westbound				KUHIO HWY Northbound				KUKUI ST Eastbound				Int. Total
	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	
07:15	12	175	0	2	2	0	0	5	5	152	8	0	8	1	6	0	376
07:30	5	161	0	3	1	0	0	1	2	166	9	4	10	0	6	2	370
07:45	9	157	0	0	4	0	0	1	5	155	2	2	17	2	12	0	366
Total	26	493	0	5	7	0	0	7	12	473	19	6	35	3	24	2	1112
08:00	8	163	0	1	7	0	0	6	4	146	0	1	11	0	5	0	352
Grand Total	34	656	0	6	14	0	0	13	16	619	19	7	46	3	29	2	1464
Apprch %	4.9	94.3	0	0.9	51.9	0	0	48.1	2.4	93.6	2.9	1.1	57.5	3.8	36.2	2.5	
Total %	2.3	44.8	0	0.4	1	0	0	0.9	1.1	42.3	1.3	0.5	3.1	0.2	2	0.1	
Motorcycles	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	2
% Motorcycles	0	0	0	0	0	0	0	0	0	0.3	0	0	0	0	0	0	0.1
Cars	20	441	0	0	8	0	0	0	9	389	15	0	36	1	18	0	937
% Cars	58.8	67.2	0	0	57.1	0	0	0	56.2	62.8	78.9	0	78.3	33.3	62.1	0	64
Light Goods Vehicles	12	193	0	0	6	0	0	0	7	204	4	0	10	2	9	0	447
% Light Goods Vehicles	35.3	29.4	0	0	42.9	0	0	0	43.8	33	21.1	0	21.7	66.7	31	0	30.5
Buses	1	9	0	0	0	0	0	0	0	3	0	0	0	0	1	0	14
% Buses	2.9	1.4	0	0	0	0	0	0	0	0.5	0	0	0	0	3.4	0	1
Single-Unit Trucks	0	11	0	0	0	0	0	0	0	20	0	0	0	0	0	0	31
% Single-Unit Trucks	0	1.7	0	0	0	0	0	0	0	3.2	0	0	0	0	0	0	2.1
Articulated Trucks	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	2
% Articulated Trucks	0	0.2	0	0	0	0	0	0	0	0.2	0	0	0	0	0	0	0.1
Bicycles on Road	1	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	3
% Bicycles on Road	2.9	0.2	0	0	0	0	0	0	0	0	0	0	0	0	3.4	0	0.2
Bicycles on Crosswalk	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1
% Bicycles on Crosswalk	0	0	0	0	0	0	0	7.7	0	0	0	0	0	0	0	0	0.1
Pedestrians	0	0	0	6	0	0	0	12	0	0	0	7	0	0	0	2	27
% Pedestrians	0	0	0	100	0	0	0	92.3	0	0	0	100	0	0	0	100	1.8

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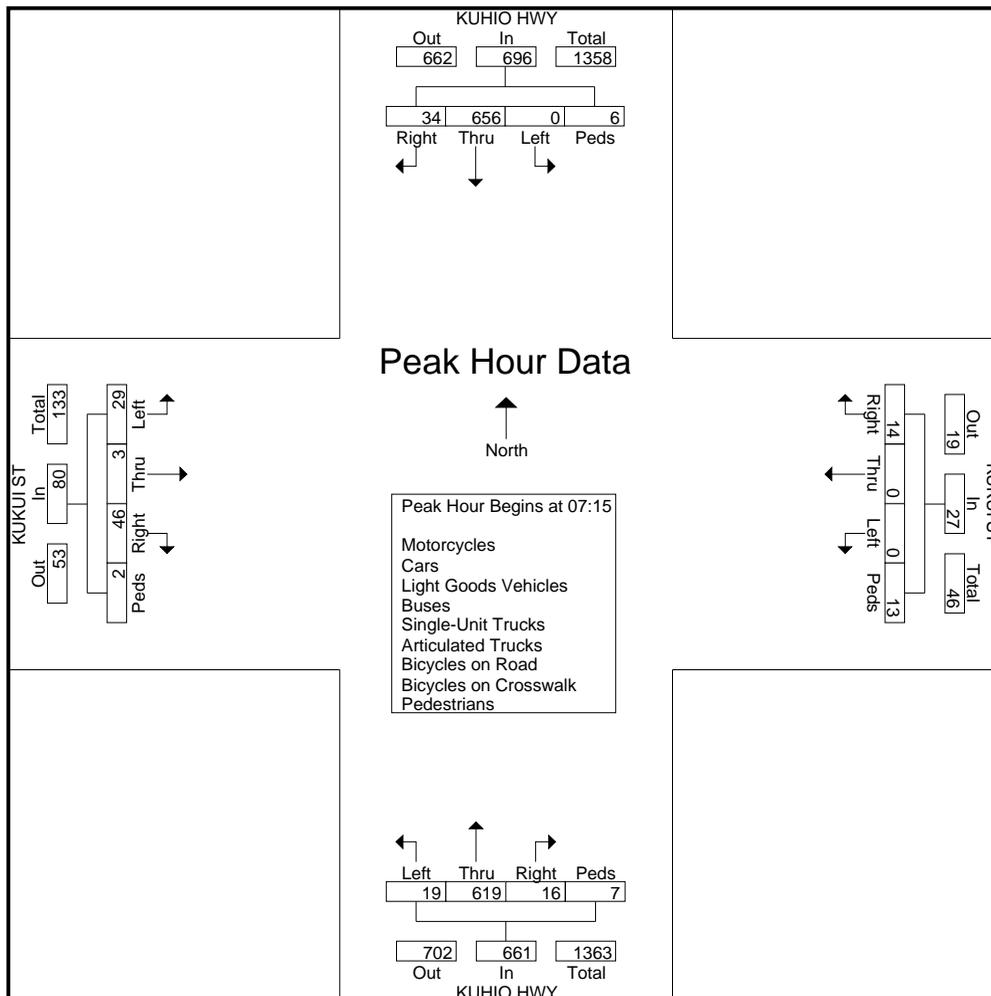
File Name : AM_Kuhio Hwy - Kukui_Huluili St

Site Code : 17-035

Start Date : 4/19/2017

Page No : 2

Start Time	KUHIO HWY Southbound					KUKUI ST Westbound					KUHIO HWY Northbound					KUKUI ST Eastbound					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 07:15 to 08:00 - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:15																					
07:15	12	175	0	2	189	2	0	0	5	7	5	152	8	0	165	8	1	6	0	15	376
07:30	5	161	0	3	169	1	0	0	1	2	2	166	9	4	181	10	0	6	2	18	370
07:45	9	157	0	0	166	4	0	0	1	5	5	155	2	2	164	17	2	12	0	31	366
08:00	8	163	0	1	172	7	0	0	6	13	4	146	0	1	151	11	0	5	0	16	352
Total Volume	34	656	0	6	696	14	0	0	13	27	16	619	19	7	661	46	3	29	2	80	1464
% App. Total	4.9	94.3	0	0.9		51.9	0	0	48.1		2.4	93.6	2.9	1.1		57.5	3.8	36.2	2.5		
PHF	.708	.937	.000	.500	.921	.500	.000	.000	.542	.519	.800	.932	.528	.438	.913	.676	.375	.604	.250	.645	.973



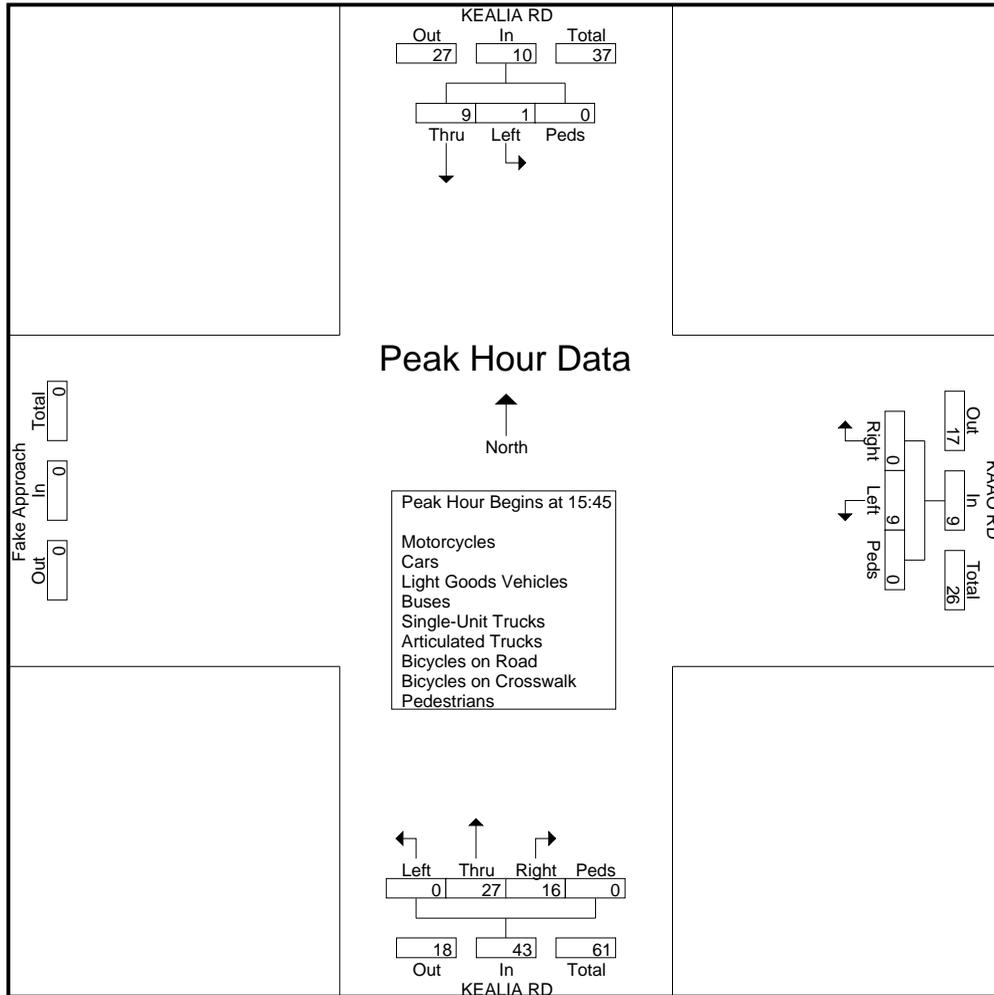
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File Name : PM_Kealia Rd - KaaO Rd
Site Code : 17-035 Kealia Residential Subdivision
Start Date : 4/18/2017
Page No : 2

Start Time	KEALIA RD Southbound				KAAO RD Westbound				KEALIA RD Northbound					Int. Total
	Thru	Left	Peds	App. Total	Right	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	4	0	0	4	0	4	0	4	6	7	0	0	13	21
16:00	0	0	0	0	0	0	0	0	3	6	0	0	9	9
16:15	4	0	0	4	0	2	0	2	5	3	0	0	8	14
16:30	1	1	0	2	0	3	0	3	2	11	0	0	13	18
Total Volume	9	1	0	10	0	9	0	9	16	27	0	0	43	62
% App. Total	90	10	0		0	100	0		37.2	62.8	0	0		
PHF	.563	.250	.000	.625	.000	.563	.000	.563	.667	.614	.000	.000	.827	.738



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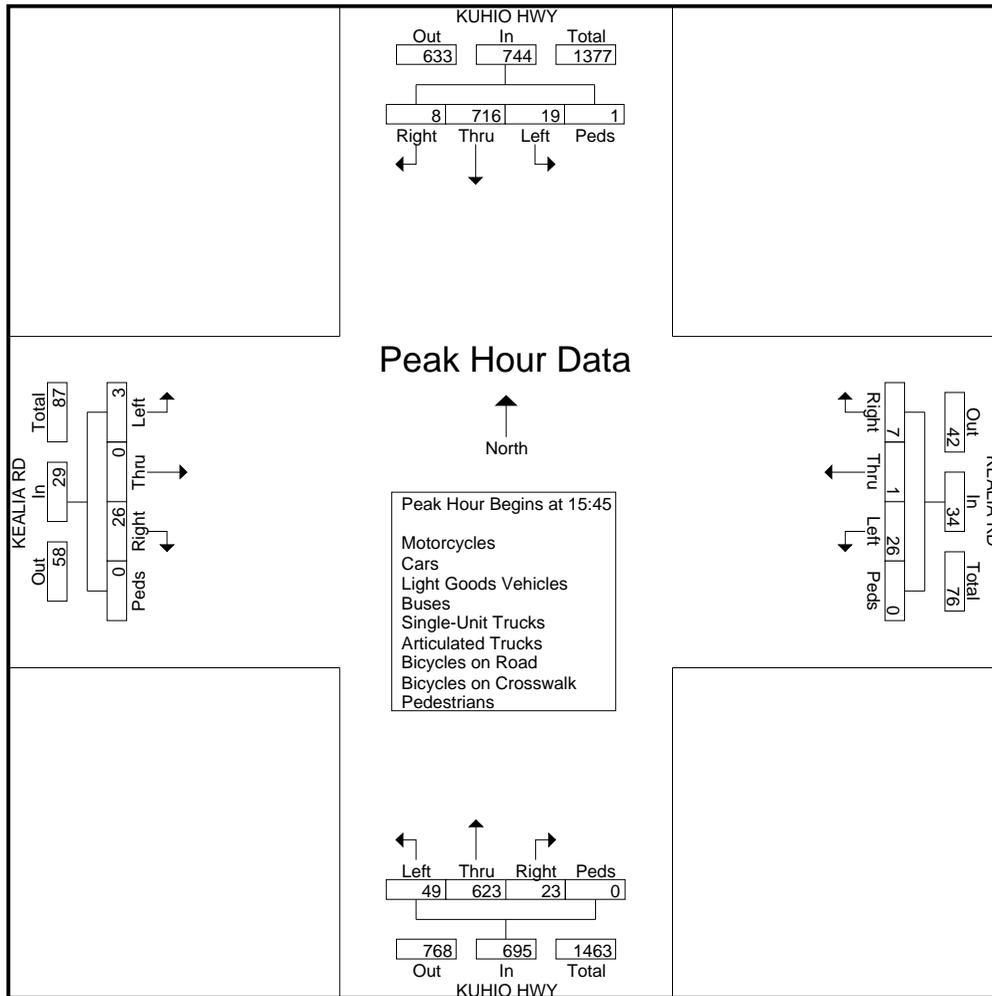
File Name : PM_Kuhio Hwy - Kealia Rd

Site Code : 17-035 Kealia Residential Subdivision

Start Date : 4/18/2017

Page No : 2

Start Time	KUHIO HWY Southbound					KEALIA RD Westbound					KUHIO HWY Northbound					KEALIA RD Eastbound					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 15:45 to 16:30 - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 15:45																					
15:45	3	163	6	0	172	2	0	8	0	10	7	133	15	0	155	12	0	2	0	14	351
16:00	1	157	1	1	160	1	0	1	0	2	6	181	14	0	201	1	0	1	0	2	365
16:15	1	177	7	0	185	2	0	10	0	12	5	161	11	0	177	6	0	0	0	6	380
16:30	3	219	5	0	227	2	1	7	0	10	5	148	9	0	162	7	0	0	0	7	406
Total Volume	8	716	19	1	744	7	1	26	0	34	23	623	49	0	695	26	0	3	0	29	1502
% App. Total	1.1	96.2	2.6	0.1		20.6	2.9	76.5	0		3.3	89.6	7.1	0		89.7	0	10.3	0		
PHF	.667	.817	.679	.250	.819	.875	.250	.650	.000	.708	.821	.860	.817	.000	.864	.542	.000	.375	.000	.518	.925



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File Name : PM_Kuhio Hwy - Mailihuna Rd

Site Code : 00000000

Start Date : 4/18/2017

Page No : 1

Groups Printed- Unshifted

Start Time	KUHIO HWY Southbound				Westbound				KUHIO HWY Northbound				MAILIHUNA RD Eastbound				Int. Total
	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	
15:45	36	157	0	0	0	0	0	0	0	137	6	0	11	0	25	0	372
Total	36	157	0	0	0	0	0	0	0	137	6	0	11	0	25	0	372
16:00	33	126	0	0	0	0	0	0	0	176	6	0	11	0	36	1	389
16:15	42	144	0	0	0	1	0	0	0	139	8	0	6	0	38	0	378
16:30	43	140	0	0	0	0	0	0	0	136	8	0	8	0	35	0	370
Grand Total	154	567	0	0	0	1	0	0	0	588	28	0	36	0	134	1	1509
Apprch %	21.4	78.6	0	0	0	100	0	0	0	95.5	4.5	0	21.1	0	78.4	0.6	
Total %	10.2	37.6	0	0	0	0.1	0	0	0	39	1.9	0	2.4	0	8.9	0.1	

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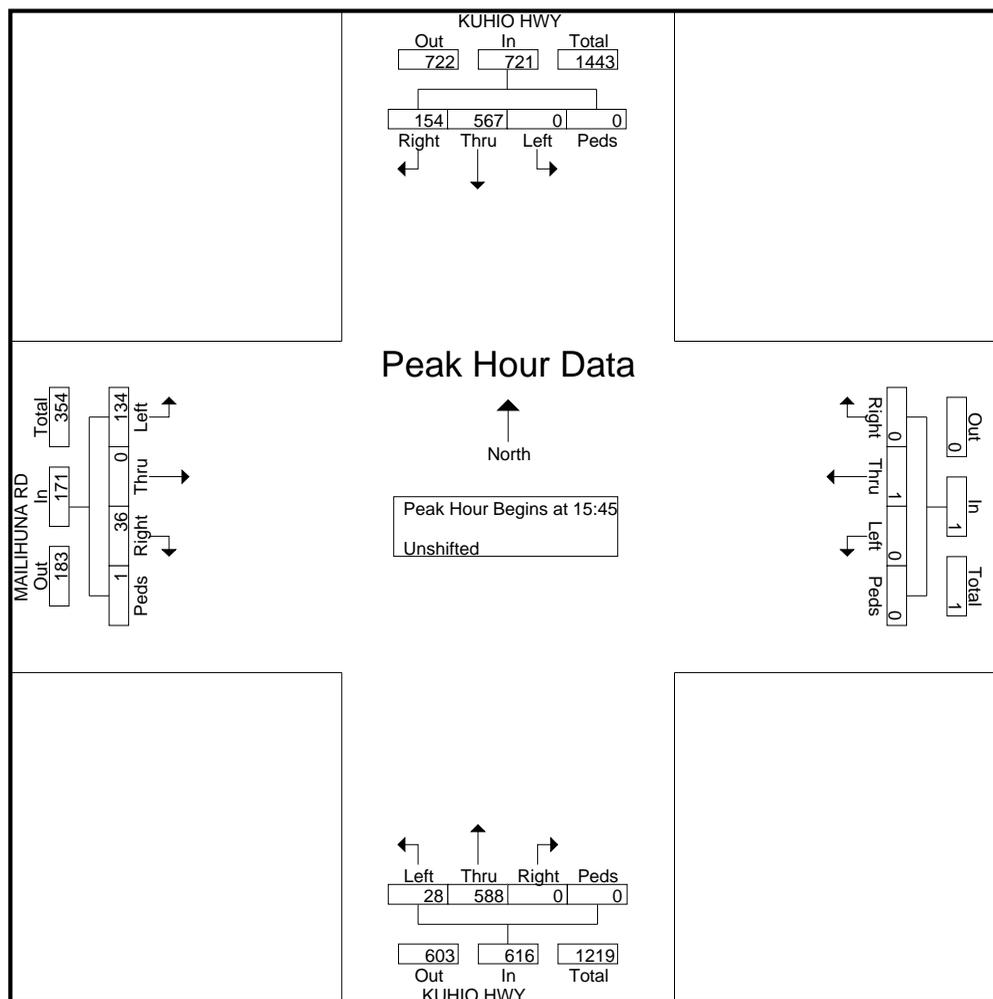
File Name : PM_Kuhio Hwy - Mailihuna Rd

Site Code : 00000000

Start Date : 4/18/2017

Page No : 2

Start Time	KUHIO HWY Southbound					Westbound					KUHIO HWY Northbound					MAILIHUNA RD Eastbound					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 15:45 to 16:30 - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 15:45																					
15:45	36	157	0	0	193	0	0	0	0	0	0	137	6	0	143	11	0	25	0	36	372
16:00	33	126	0	0	159	0	0	0	0	0	0	176	6	0	182	11	0	36	1	48	389
16:15	42	144	0	0	186	0	1	0	0	1	0	139	8	0	147	6	0	38	0	44	378
16:30	43	140	0	0	183	0	0	0	0	0	0	136	8	0	144	8	0	35	0	43	370
Total Volume	154	567	0	0	721	0	1	0	0	1	0	588	28	0	616	36	0	134	1	171	1509
% App. Total	21.4	78.6	0	0		0	100	0	0		0	95.5	4.5	0		21.1	0	78.4	0.6		
PHF	.895	.903	.000	.000	.934	.000	.250	.000	.000	.250	.000	.835	.875	.000	.846	.818	.000	.882	.250	.891	.970



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File Name : PM_Kuhio Hwy - Kawaihau Rd

Site Code : 00000000

Start Date : 4/18/2017

Page No : 1

Groups Printed- Unshifted

Start Time	KUHIO HWY Southbound				Westbound				KUHIO HWY Northbound				KAWAIHAU RD Eastbound				Int. Total	
	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds		
15:30	4	163	0	3	0	0	0	0	0	125	51	0	54	0	0	0	1	401
15:45	2	169	0	2	0	0	0	0	0	152	57	0	69	0	0	0	0	451
Total	6	332	0	5	0	0	0	0	0	277	108	0	123	0	0	0	1	852
16:00	5	138	0	0	0	0	0	0	0	163	58	0	55	0	0	0	0	419
16:15	3	156	0	5	0	0	0	0	0	135	65	0	29	0	1	8	8	402
16:30	3	181	0	1	0	0	0	0	0	160	64	0	58	0	0	0	0	467
16:45	4	157	0	1	0	0	0	0	0	167	55	0	54	0	0	0	2	440
Total	15	632	0	7	0	0	0	0	0	625	242	0	196	0	1	10	10	1728
17:00	2	135	0	2	0	0	0	0	0	145	52	0	52	0	0	0	1	389
17:15	2	132	0	3	0	0	0	0	0	133	67	0	39	0	0	0	1	377
Grand Total	25	1231	0	17	0	0	0	0	0	1180	469	0	410	0	1	13	13	3346
Apprch %	2	96.7	0	1.3	0	0	0	0	0	71.6	28.4	0	96.7	0	0.2	3.1	3.1	
Total %	0.7	36.8	0	0.5	0	0	0	0	0	35.3	14	0	12.3	0	0	0.4	0.4	

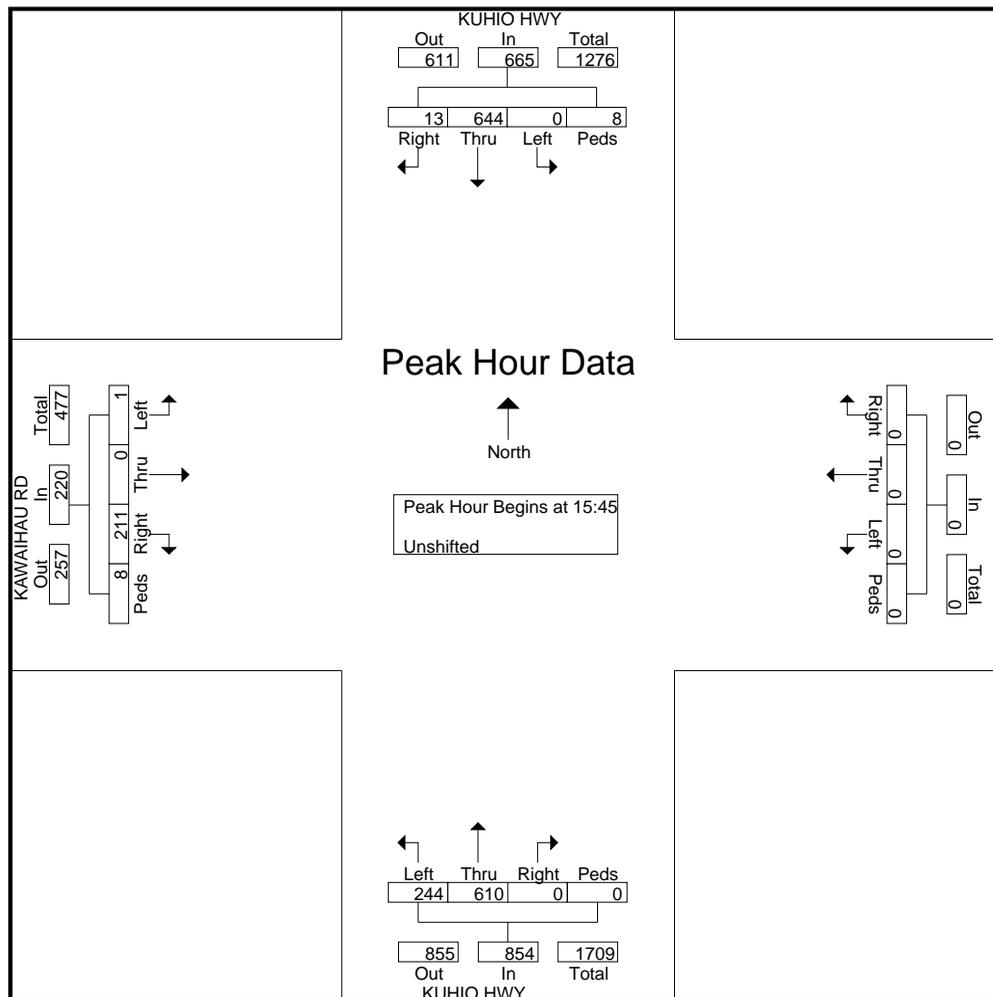
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File Name : PM_Kuhio Hwy - Kawaihau Rd
Site Code : 00000000
Start Date : 4/18/2017
Page No : 2

Start Time	KUHIO HWY Southbound					Westbound					KUHIO HWY Northbound					KAWAIHAU RD Eastbound					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 15:30 to 17:15 - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 15:45																					
15:45	2	169	0	2	173	0	0	0	0	0	0	152	57	0	209	69	0	0	0	69	451
16:00	5	138	0	0	143	0	0	0	0	0	0	163	58	0	221	55	0	0	0	55	419
16:15	3	156	0	5	164	0	0	0	0	0	0	135	65	0	200	29	0	1	8	38	402
16:30	3	181	0	1	185	0	0	0	0	0	0	160	64	0	224	58	0	0	0	58	467
Total Volume	13	644	0	8	665	0	0	0	0	0	0	610	244	0	854	211	0	1	8	220	1739
% App. Total	2	96.8	0	1.2		0	0	0	0	0	0	71.4	28.6	0		95.9	0	0.5	3.6		
PHF	.650	.890	.000	.400	.899	.000	.000	.000	.000	.000	.000	.936	.938	.000	.953	.764	.000	.250	.250	.797	.931



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File Name : PM_Kuhio Hwy - Hauaala Rd

Site Code : 00000000

Start Date : 4/18/2017

Page No : 1

Groups Printed- Unshifted

Start Time	KUHIO HWY Southbound				Westbound				KUHIO HWY Northbound				HAUAALA RD Eastbound				Int. Total
	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	
15:30	1	215	0	0	0	0	0	0	0	176	26	0	36	0	0	1	455
15:45	4	235	0	0	0	0	0	0	0	209	30	0	41	0	1	0	520
Total	5	450	0	0	0	0	0	0	0	385	56	0	77	0	1	1	975
16:00	3	190	0	0	0	0	0	0	0	221	27	0	42	0	1	0	484
16:15	5	185	0	0	0	0	0	0	0	200	22	0	33	0	0	8	453
16:30	3	238	0	0	0	0	0	0	0	222	20	0	40	0	1	0	524
16:45	1	210	0	0	0	0	0	0	0	224	23	0	26	0	2	2	488
Total	12	823	0	0	0	0	0	0	0	867	92	0	141	0	4	10	1949
17:00	4	183	0	0	0	0	0	0	0	198	22	0	34	0	0	1	442
17:15	0	171	0	0	0	0	0	0	0	200	28	0	46	0	1	1	447
Grand Total	21	1627	0	0	0	0	0	0	0	1650	198	0	298	0	6	13	3813
Apprch %	1.3	98.7	0	0	0	0	0	0	0	89.3	10.7	0	94	0	1.9	4.1	
Total %	0.6	42.7	0	0	0	0	0	0	0	43.3	5.2	0	7.8	0	0.2	0.3	

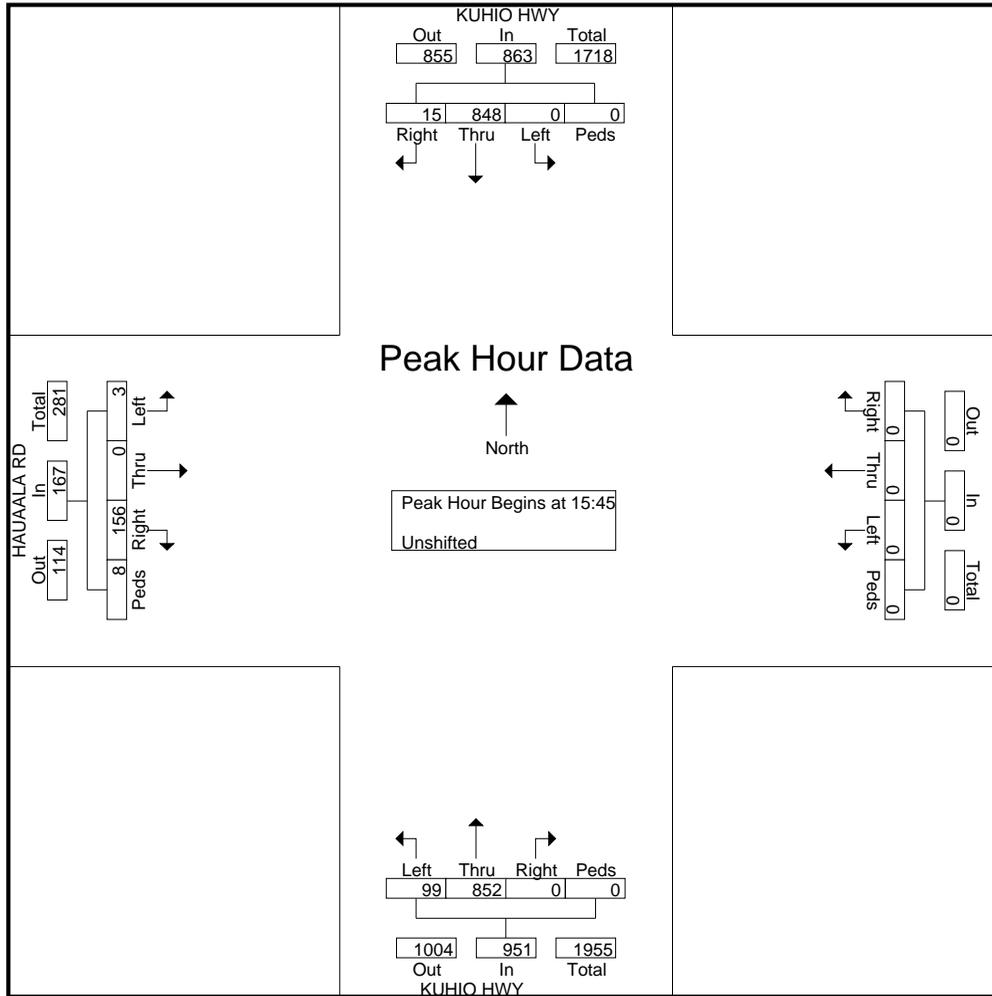
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File Name : PM_Kuhio Hwy - Hauaala Rd
Site Code : 00000000
Start Date : 4/18/2017
Page No : 2

Start Time	KUHIO HWY Southbound					Westbound					KUHIO HWY Northbound					HAUAALA RD Eastbound					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 15:30 to 17:15 - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 15:45																					
15:45	4	235	0	0	239	0	0	0	0	0	0	209	30	0	239	41	0	1	0	42	520
16:00	3	190	0	0	193	0	0	0	0	0	0	221	27	0	248	42	0	1	0	43	484
16:15	5	185	0	0	190	0	0	0	0	0	0	200	22	0	222	33	0	0	8	41	453
16:30	3	238	0	0	241	0	0	0	0	0	0	222	20	0	242	40	0	1	0	41	524
Total Volume	15	848	0	0	863	0	0	0	0	0	0	852	99	0	951	156	0	3	8	167	1981
% App. Total	1.7	98.3	0	0		0	0	0	0		0	89.6	10.4	0		93.4	0	1.8	4.8		
PHF	.750	.891	.000	.000	.895	.000	.000	.000	.000	.000	.000	.959	.825	.000	.959	.929	.000	.750	.250	.971	.945



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File Name : PM_Kuhio Hwy - Cane Haul Rd

Site Code : 00000000

Start Date : 4/18/2017

Page No : 1

Groups Printed- Unshifted

Start Time	KUHIO HWY Southbound				Westbound				KUHIO HWY Northbound				CANE HAUL RD Eastbound				Int. Total	
	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds		
15:30	71	180	0	0	0	0	0	0	0	202	7	0	0	0	0	0	0	460
15:45	73	201	0	0	0	0	0	0	0	239	3	0	0	0	0	0	0	516
Total	144	381	0	0	0	0	0	0	0	441	10	0	0	0	0	0	0	976
16:00	71	159	0	0	0	0	0	0	0	248	7	0	0	0	0	0	0	485
16:15	70	167	0	0	0	0	0	0	0	222	2	0	0	0	0	0	0	461
16:30	81	169	0	0	0	0	0	0	0	242	2	0	0	0	0	0	0	494
16:45	72	170	0	0	0	0	0	0	0	247	3	0	0	0	0	0	0	492
Total	294	665	0	0	0	0	0	0	0	959	14	0	0	0	0	0	0	1932
17:00	57	164	0	0	0	0	0	0	0	220	2	0	0	0	0	0	0	443
17:15	58	167	0	0	0	0	0	0	0	228	2	0	0	0	0	0	0	455
Grand Total	553	1377	0	0	0	0	0	0	0	1848	28	0	0	0	0	0	0	3806
Apprch %	28.7	71.3	0	0	0	0	0	0	0	98.5	1.5	0	0	0	0	0	0	
Total %	14.5	36.2	0	0	0	0	0	0	0	48.6	0.7	0	0	0	0	0	0	

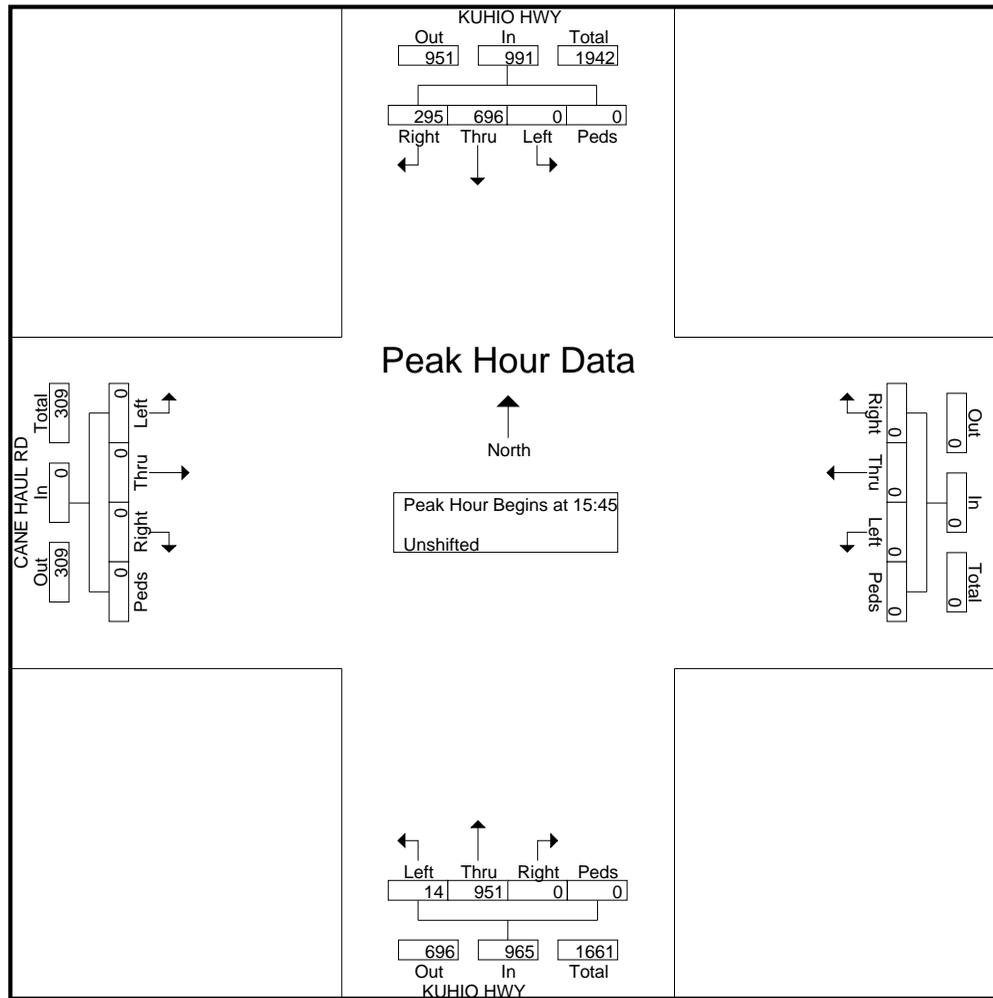
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File Name : PM_Kuhio Hwy - Cane Haul Rd
Site Code : 00000000
Start Date : 4/18/2017
Page No : 2

Start Time	KUHIO HWY Southbound					Westbound					KUHIO HWY Northbound					CANE HAUL RD Eastbound					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 15:30 to 17:15 - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 15:45																					
15:45	73	201	0	0	274	0	0	0	0	0	0	239	3	0	242	0	0	0	0	0	516
16:00	71	159	0	0	230	0	0	0	0	0	0	248	7	0	255	0	0	0	0	0	485
16:15	70	167	0	0	237	0	0	0	0	0	0	222	2	0	224	0	0	0	0	0	461
16:30	81	169	0	0	250	0	0	0	0	0	0	242	2	0	244	0	0	0	0	0	494
Total Volume	295	696	0	0	991	0	0	0	0	0	0	951	14	0	965	0	0	0	0	0	1956
% App. Total	29.8	70.2	0	0		0	0	0	0		0	98.5	1.5	0		0	0	0	0		
PHF	.910	.866	.000	.000	.904	.000	.000	.000	.000	.000	.000	.959	.500	.000	.946	.000	.000	.000	.000	.000	.948



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File Name : PM_Kuhio Hwy - Lehua St

Site Code : 17-035 Kealia Residential Subdivision

Start Date : 4/18/2017

Page No : 1

Groups Printed- Motorcycles - Cars - Light Goods Vehicles - Buses - Unit Trucks - Articulated Trucks - Bicycles on Road - Bicycles on Crosswalk - Pedestrians

Start Time	KUHIO HWY Southbound			KUHIO HWY Northbound			LEHUA ST Eastbound			Int. Total
	Right	Thru	Peds	Thru	Left	Peds	Right	Left	Peds	
15:45	39	157	0	166	5	0	7	71	1	446
Total	39	157	0	166	5	0	7	71	1	446
16:00	35	141	0	174	2	0	0	87	4	443
16:15	35	124	0	154	4	0	2	80	1	400
16:30	42	149	0	170	7	0	0	59	2	429
Grand Total	151	571	0	664	18	0	9	297	8	1718
Apprch %	20.9	79.1	0	97.4	2.6	0	2.9	94.6	2.5	
Total %	8.8	33.2	0	38.6	1	0	0.5	17.3	0.5	
Motorcycles	0	1	0	4	0	0	0	1	0	6
% Motorcycles	0	0.2	0	0.6	0	0	0	0.3	0	0.3
Cars	100	423	0	479	13	0	6	185	0	1206
% Cars	66.2	74.1	0	72.1	72.2	0	66.7	62.3	0	70.2
Light Goods Vehicles	41	136	0	176	5	0	3	106	0	467
% Light Goods Vehicles	27.2	23.8	0	26.5	27.8	0	33.3	35.7	0	27.2
Buses	4	1	0	1	0	0	0	4	0	10
% Buses	2.6	0.2	0	0.2	0	0	0	1.3	0	0.6
Single-Unit Trucks	5	6	0	2	0	0	0	1	0	14
% Single-Unit Trucks	3.3	1.1	0	0.3	0	0	0	0.3	0	0.8
Articulated Trucks	0	1	0	0	0	0	0	0	0	1
% Articulated Trucks	0	0.2	0	0	0	0	0	0	0	0.1
Bicycles on Road	1	3	0	2	0	0	0	0	0	6
% Bicycles on Road	0.7	0.5	0	0.3	0	0	0	0	0	0.3
Bicycles on Crosswalk	0	0	0	0	0	0	0	0	0	0
% Bicycles on Crosswalk	0	0	0	0	0	0	0	0	0	0
Pedestrians	0	0	0	0	0	0	0	0	8	8
% Pedestrians	0	0	0	0	0	0	0	0	100	0.5

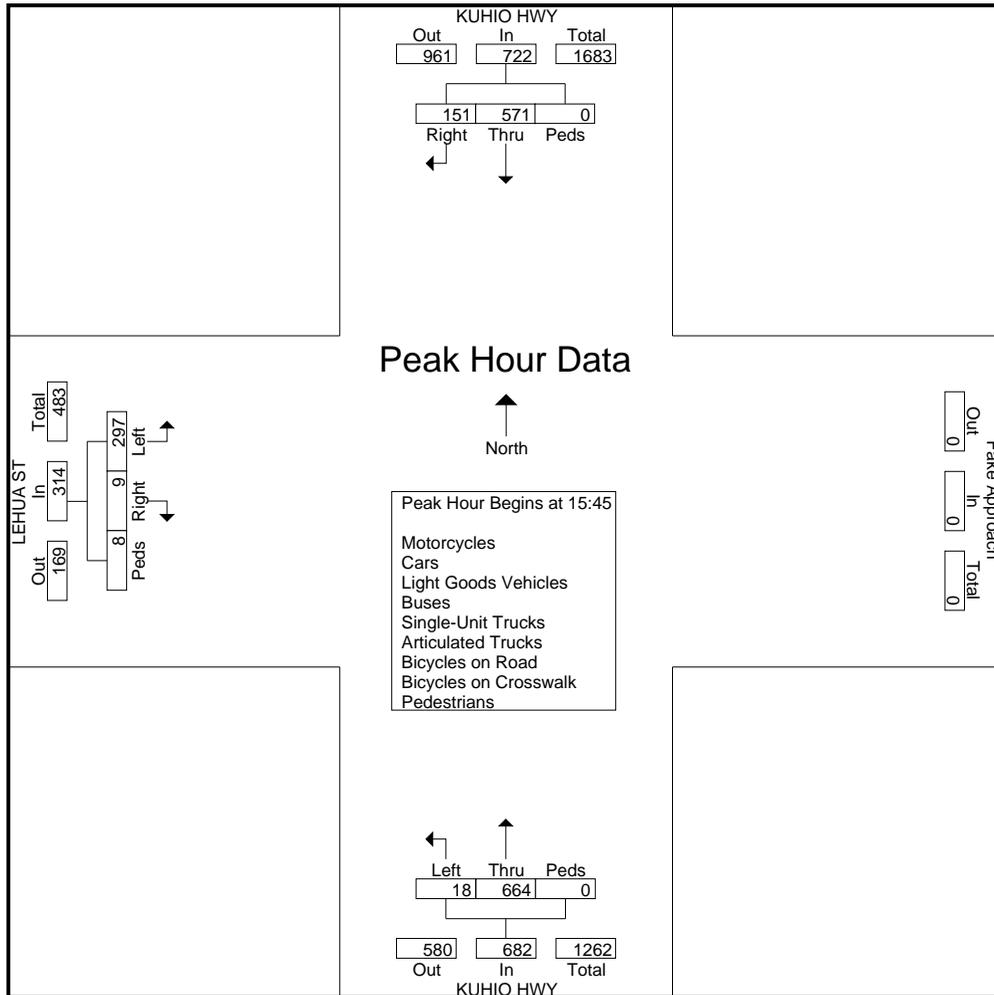
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File Name : PM_Kuhio Hwy - Lehua St
Site Code : 17-035 Kealia Residential Subdivision
Start Date : 4/18/2017
Page No : 2

Start Time	KUHIO HWY Southbound				KUHIO HWY Northbound				LEHUA ST Eastbound				Int. Total
	Right	Thru	Peds	App. Total	Thru	Left	Peds	App. Total	Right	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	39	157	0	196	166	5	0	171	7	71	1	79	446
16:00	35	141	0	176	174	2	0	176	0	87	4	91	443
16:15	35	124	0	159	154	4	0	158	2	80	1	83	400
16:30	42	149	0	191	170	7	0	177	0	59	2	61	429
Total Volume	151	571	0	722	664	18	0	682	9	297	8	314	1718
% App. Total	20.9	79.1	0		97.4	2.6	0		2.9	94.6	2.5		
PHF	.899	.909	.000	.921	.954	.643	.000	.963	.321	.853	.500	.863	.963



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File Name : PM_Kuhio Hwy - Niu St

Site Code : 17-035 Kealia Residential Subdivision

Start Date : 4/18/2017

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Groups Printed- Motorcycles - Cars - Light Goods Vehicles - Buses - Unit Trucks - Articulated Trucks - Bicycles on Road - Bicycles on Crosswalk - Pedestrians

Start Time	KUHIO HWY Southbound				NIU ST Westbound				KUHIO HWY Northbound				NIU ST Eastbound				Int. Total
	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	
15:30	4	152	11	0	13	1	0	4	1	147	3	10	2	0	2	10	360
15:45	6	151	9	0	22	0	1	9	1	146	9	8	4	0	0	5	371
Total	10	303	20	0	35	1	1	13	2	293	12	18	6	0	2	15	731
16:00	1	142	6	0	21	1	1	15	3	159	1	10	5	1	0	6	372
16:15	7	111	8	0	25	1	1	3	0	139	5	9	11	0	0	9	329
16:30	1	139	13	0	26	1	2	8	0	153	4	7	3	0	1	10	368
16:45	2	153	6	2	12	1	0	10	4	149	1	19	4	1	0	4	368
Total	11	545	33	2	84	4	4	36	7	600	11	45	23	2	1	29	1437
17:00	1	146	3	1	6	1	0	7	2	145	2	13	7	1	0	8	343
17:15	5	137	4	1	7	2	3	1	1	164	2	7	4	0	1	15	354
Grand Total	27	1131	60	4	132	8	8	57	12	1202	27	83	40	3	4	67	2865
Apprch %	2.2	92.6	4.9	0.3	64.4	3.9	3.9	27.8	0.9	90.8	2	6.3	35.1	2.6	3.5	58.8	
Total %	0.9	39.5	2.1	0.1	4.6	0.3	0.3	2	0.4	42	0.9	2.9	1.4	0.1	0.1	2.3	
Motorcycles	0	3	1	0	2	0	1	0	0	2	0	0	1	0	0	0	10
% Motorcycles	0	0.3	1.7	0	1.5	0	12.5	0	0	0.2	0	0	2.5	0	0	0	0.3
Cars	20	829	41	0	85	7	7	0	10	857	20	0	21	2	3	0	1902
% Cars	74.1	73.3	68.3	0	64.4	87.5	87.5	0	83.3	71.3	74.1	0	52.5	66.7	75	0	66.4
Light Goods Vehicles	7	276	18	0	42	1	0	0	0	329	7	0	14	1	1	0	696
% Light Goods Vehicles	25.9	24.4	30	0	31.8	12.5	0	0	0	27.4	25.9	0	35	33.3	25	0	24.3
Buses	0	2	0	0	0	0	0	0	0	2	0	0	0	0	0	0	4
% Buses	0	0.2	0	0	0	0	0	0	0	0.2	0	0	0	0	0	0	0.1
Single-Unit Trucks	0	12	0	0	2	0	0	0	0	8	0	0	3	0	0	0	25
% Single-Unit Trucks	0	1.1	0	0	1.5	0	0	0	0	0.7	0	0	7.5	0	0	0	0.9
Articulated Trucks	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
% Articulated Trucks	0	0.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1
Bicycles on Road	0	6	0	0	1	0	0	0	2	4	0	0	1	0	0	0	14
% Bicycles on Road	0	0.5	0	0	0.8	0	0	0	16.7	0.3	0	0	2.5	0	0	0	0.5
Bicycles on Crosswalk	0	0	0	2	0	0	0	3	0	0	0	6	0	0	0	3	14
% Bicycles on Crosswalk	0	0	0	50	0	0	0	5.3	0	0	0	7.2	0	0	0	4.5	0.5
Pedestrians	0	0	0	2	0	0	0	54	0	0	0	77	0	0	0	64	197
% Pedestrians	0	0	0	50	0	0	0	94.7	0	0	0	92.8	0	0	0	95.5	6.9

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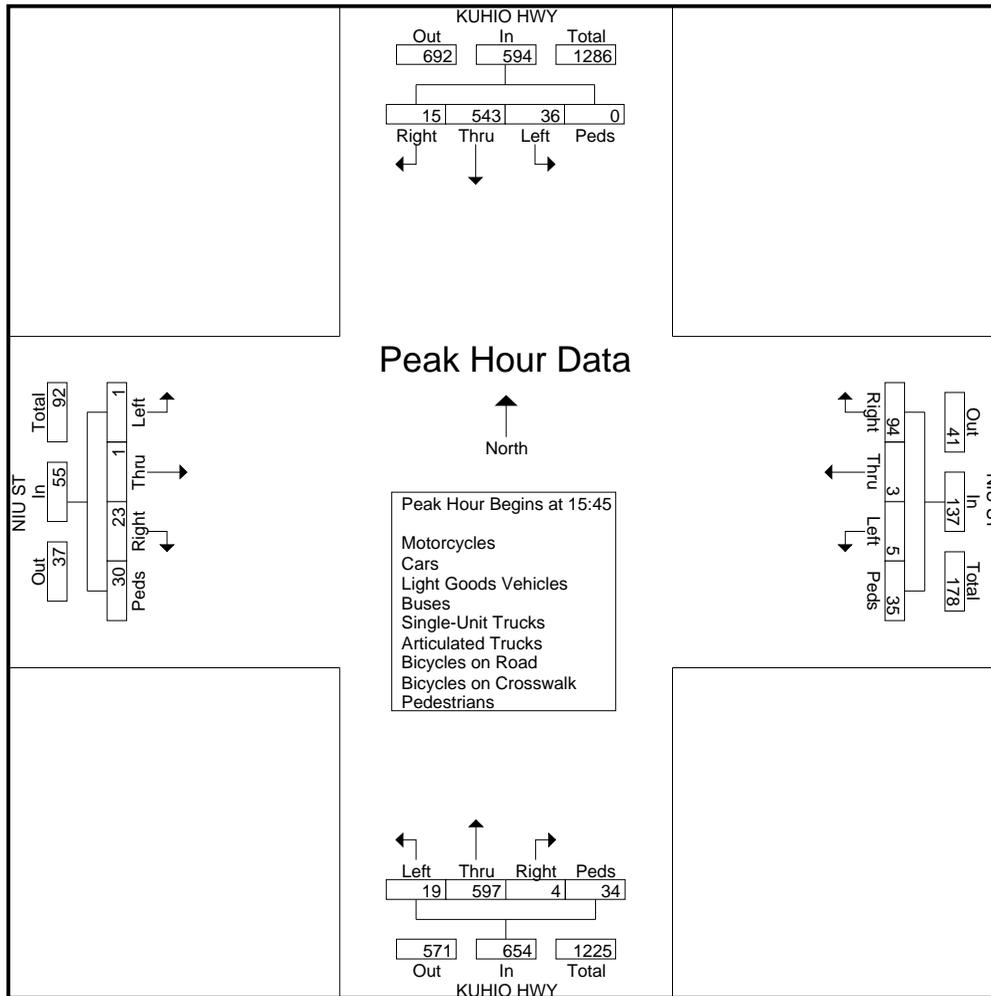
File Name : PM_Kuhio Hwy - Niu St

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Start Time	KUHIO HWY Southbound					NIU ST Westbound					KUHIO HWY Northbound					NIU ST Eastbound					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 15:30 to 17:15 - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 15:45																					
15:45	6	151	9	0	166	22	0	1	9	32	1	146	9	8	164	4	0	0	5	9	371
16:00	1	142	6	0	149	21	1	1	15	38	3	159	1	10	173	5	1	0	6	12	372
16:15	7	111	8	0	126	25	1	1	3	30	0	139	5	9	153	11	0	0	9	20	329
16:30	1	139	13	0	153	26	1	2	8	37	0	153	4	7	164	3	0	1	10	14	368
Total Volume	15	543	36	0	594	94	3	5	35	137	4	597	19	34	654	23	1	1	30	55	1440
% App. Total	2.5	91.4	6.1	0		68.6	2.2	3.6	25.5		0.6	91.3	2.9	5.2		41.8	1.8	1.8	54.5		
PHF	.536	.899	.692	.000	.895	.904	.750	.625	.583	.901	.333	.939	.528	.850	.945	.523	.250	.250	.750	.688	.968



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Groups Printed- Motorcycles - Cars - Light Goods Vehicles - Buses - Unit Trucks - Articulated Trucks - Bicycles on Road - Bicycles on Crosswalk - Pedestrians

Start Time	KUHIO HWY Southbound				KUKUI ST Westbound				KUHIO HWY Northbound				KUKUI ST Eastbound				Int. Total
	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	
15:30	11	143	2	2	5	0	0	17	3	135	7	9	4	2	6	9	355
15:45	13	144	1	6	6	0	0	15	1	153	11	8	16	6	6	7	393
Total	24	287	3	8	11	0	0	32	4	288	18	17	20	8	12	16	748
16:00	12	135	1	8	3	0	0	28	2	157	8	8	12	2	8	13	397
16:15	11	112	2	8	9	0	0	10	3	130	4	6	7	0	3	8	313
16:30	13	134	0	8	5	0	0	15	1	138	8	19	6	2	9	18	376
16:45	12	139	1	4	3	0	0	15	1	135	8	12	5	0	10	8	353
Total	48	520	4	28	20	0	0	68	7	560	28	45	30	4	30	47	1439
17:00	7	134	0	7	3	0	0	9	2	130	4	10	4	0	7	0	317
17:15	11	134	1	6	3	0	0	25	1	155	13	11	3	2	8	11	384
Grand Total	90	1075	8	49	37	0	0	134	14	1133	63	83	57	14	57	74	2888
Apprch %	7.4	88	0.7	4	21.6	0	0	78.4	1.1	87.6	4.9	6.4	28.2	6.9	28.2	36.6	
Total %	3.1	37.2	0.3	1.7	1.3	0	0	4.6	0.5	39.2	2.2	2.9	2	0.5	2	2.6	
Motorcycles	1	3	0	0	0	0	0	0	0	2	0	0	0	0	0	0	6
% Motorcycles	1.1	0.3	0	0	0	0	0	0	0	0.2	0	0	0	0	0	0	0.2
Cars	62	786	5	0	31	0	0	0	13	809	47	0	43	9	42	0	1847
% Cars	68.9	73.1	62.5	0	83.8	0	0	0	92.9	71.4	74.6	0	75.4	64.3	73.7	0	64
Light Goods Vehicles	24	266	3	0	6	0	0	0	1	311	15	0	13	4	15	0	658
% Light Goods Vehicles	26.7	24.7	37.5	0	16.2	0	0	0	7.1	27.4	23.8	0	22.8	28.6	26.3	0	22.8
Buses	0	2	0	0	0	0	0	0	0	1	1	0	1	0	0	0	5
% Buses	0	0.2	0	0	0	0	0	0	0	0.1	1.6	0	1.8	0	0	0	0.2
Single-Unit Trucks	2	11	0	0	0	0	0	0	0	8	0	0	0	1	0	0	22
% Single-Unit Trucks	2.2	1	0	0	0	0	0	0	0	0.7	0	0	0	7.1	0	0	0.8
Articulated Trucks	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
% Articulated Trucks	0	0.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1
Bicycles on Road	1	5	0	0	0	0	0	0	0	2	0	0	0	0	0	0	8
% Bicycles on Road	1.1	0.5	0	0	0	0	0	0	0	0.2	0	0	0	0	0	0	0.3
Bicycles on Crosswalk	0	0	0	0	0	0	0	5	0	0	0	3	0	0	0	2	10
% Bicycles on Crosswalk	0	0	0	0	0	0	0	3.7	0	0	0	3.6	0	0	0	2.7	0.3
Pedestrians	0	0	0	49	0	0	0	129	0	0	0	80	0	0	0	72	330
% Pedestrians	0	0	0	100	0	0	0	96.3	0	0	0	96.4	0	0	0	97.3	11.4

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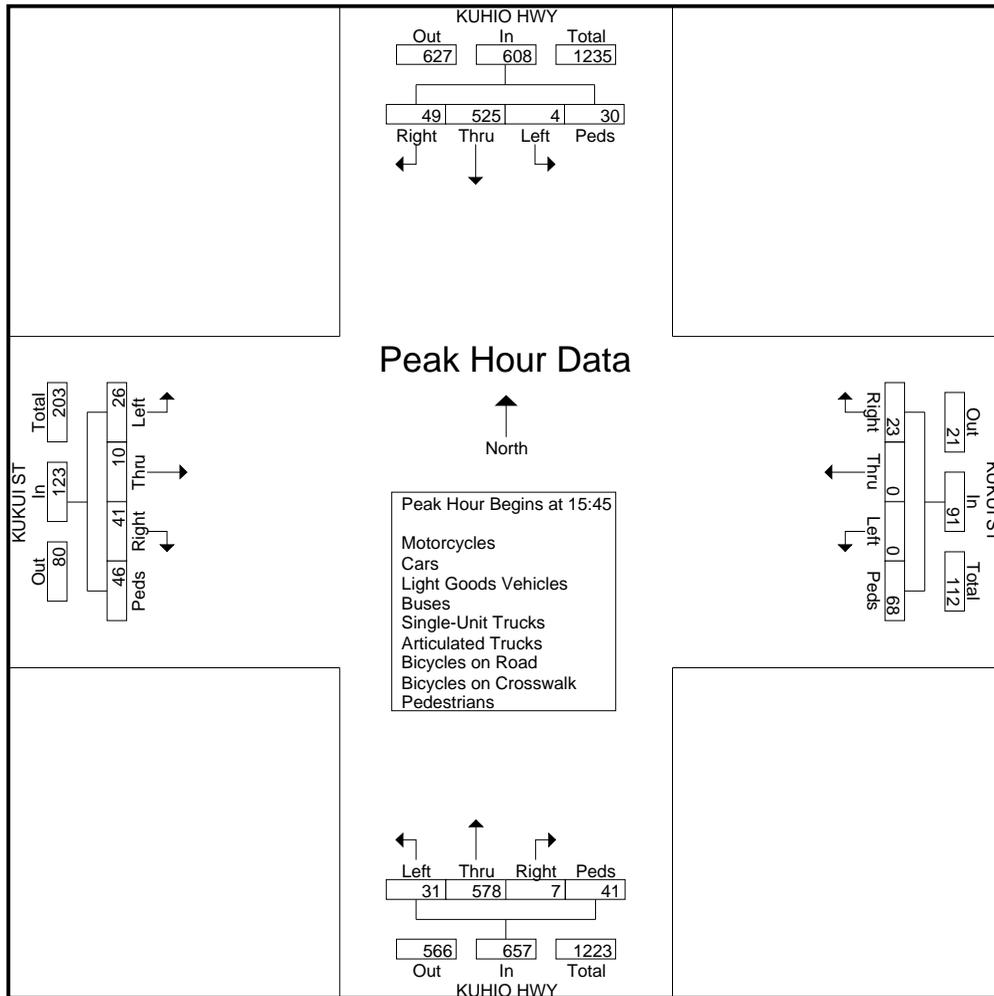
File Name : PM_Kuhio Hwy - Kukui_Huluili St

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Start Time	KUHIO HWY Southbound					KUKUI ST Westbound					KUHIO HWY Northbound					KUKUI ST Eastbound					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 15:30 to 17:15 - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 15:45																					
15:45	13	144	1	6	164	6	0	0	15	21	1	153	11	8	173	16	6	6	7	35	393
16:00	12	135	1	8	156	3	0	0	28	31	2	157	8	8	175	12	2	8	13	35	397
16:15	11	112	2	8	133	9	0	0	10	19	3	130	4	6	143	7	0	3	8	18	313
16:30	13	134	0	8	155	5	0	0	15	20	1	138	8	19	166	6	2	9	18	35	376
Total Volume	49	525	4	30	608	23	0	0	68	91	7	578	31	41	657	41	10	26	46	123	1479
% App. Total	8.1	86.3	0.7	4.9		25.3	0	0	74.7		1.1	88	4.7	6.2		33.3	8.1	21.1	37.4		
PHF	.942	.911	.500	.938	.927	.639	.000	.000	.607	.734	.583	.920	.705	.539	.939	.641	.417	.722	.639	.879	.931





APPENDIX B

LEVEL OF SERVICE CRITERIA

APPENDIX B – LEVEL OF SERVICE (LOS) CRITERIA

VEHICULAR LEVEL OF SERVICE FOR SIGNALIZED INTERSECTIONS (HCM 2010)

Level of service for vehicles at 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 the table below.

Level-of Service Criteria for Signalized Intersections

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

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

VEHICULAR LEVEL OF SERVICE CRITERIA FOR UNSIGNALIZED INTERSECTIONS (HCM 2010)

The level of service criteria for vehicles at unsignalized intersections is defined as the average control delay, in seconds per vehicle.

LOS delay threshold values are lower for two-way stop-controlled (TWSC) and all-way stop-controlled (AWSC) intersections than those of signalized intersections. This is because more vehicles pass through signalized intersections, and therefore, drivers expect and tolerate greater delays. 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 Control Delay (sec/veh)
A	≤ 10
B	>10 and ≤15
C	>15 and ≤25
D	>25 and ≤35
E	>35 and ≤50
F	> 50



APPENDIX C

LEVEL OF SERVICE CALCULATIONS



APPENDIX C

LEVEL OF SERVICE CALCULATIONS

- Existing AM Peak
-
-

Intersection						
Int Delay, s/veh	4.1					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	W		T			T
Traffic Vol, veh/h	17	3	3	13	2	8
Future Vol, veh/h	17	3	3	13	2	8
Conflicting Peds, #/hr	1	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	18	3	3	14	2	9

Major/Minor	Minor1	Major1	Major2			
Conflicting Flow All	24	10	0	0	17	0
Stage 1	10	-	-	-	-	-
Stage 2	14	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	992	1071	-	-	1600	-
Stage 1	1013	-	-	-	-	-
Stage 2	1009	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	990	1071	-	-	1600	-
Mov Cap-2 Maneuver	990	-	-	-	-	-
Stage 1	1012	-	-	-	-	-
Stage 2	1008	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	8.7	0	1.5
HCM LOS	A		

Minor Lane/Major Mvmt	NBT	NBRWBLn1	SBL	SBT
Capacity (veh/h)	-	-	1001	1600
HCM Lane V/C Ratio	-	-	0.022	0.001
HCM Control Delay (s)	-	-	8.7	7.3
HCM Lane LOS	-	-	A	A
HCM 95th %tile Q(veh)	-	-	0.1	0

Intersection

Int Delay, s/veh 1.7

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕		↕	↕		↕	↕	
Traffic Vol, veh/h	9	0	24	20	1	6	20	626	30	9	655	4
Future Vol, veh/h	9	0	24	20	1	6	20	626	30	9	655	4
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None									
Storage Length	-	-	-	-	-	-	150	-	-	150	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	10	0	26	22	1	7	22	680	33	10	712	4

Major/Minor	Minor2		Minor1		Major1		Major2					
Conflicting Flow All	1479	1491	714	1488	1477	697	716	0	0	713	0	0
Stage 1	734	734	-	741	741	-	-	-	-	-	-	-
Stage 2	745	757	-	747	736	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	104	124	431	102	126	441	885	-	-	887	-	-
Stage 1	412	426	-	408	423	-	-	-	-	-	-	-
Stage 2	406	416	-	405	425	-	-	-	-	-	-	-
Platoon blocked, %								-	-	-	-	-
Mov Cap-1 Maneuver	99	120	431	93	121	441	885	-	-	887	-	-
Mov Cap-2 Maneuver	99	120	-	93	121	-	-	-	-	-	-	-
Stage 1	402	421	-	398	412	-	-	-	-	-	-	-
Stage 2	389	406	-	376	420	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	24	47.2	0.3	0.1
HCM LOS	C	E		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1WBLn1	SBL	SBT	SBR
Capacity (veh/h)	885	-	-	225	114	887	-
HCM Lane V/C Ratio	0.025	-	-	0.159	0.257	0.011	-
HCM Control Delay (s)	9.2	-	-	24	47.2	9.1	-
HCM Lane LOS	A	-	-	C	E	A	-
HCM 95th %tile Q(veh)	0.1	-	-	0.6	1	0	-

Intersection						
Int Delay, s/veh	89.9					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	234	78	96	459	534	163
Future Vol, veh/h	234	78	96	459	534	163
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	50
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	254	85	104	499	580	177

Major/Minor	Minor2	Major1	Major2			
Conflicting Flow All	1287	580	757	0	-	0
Stage 1	580	-	-	-	-	-
Stage 2	707	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	~ 181	514	854	-	-	-
Stage 1	560	-	-	-	-	-
Stage 2	489	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	~ 151	514	854	-	-	-
Mov Cap-2 Maneuver	~ 151	-	-	-	-	-
Stage 1	466	-	-	-	-	-
Stage 2	489	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s\$	447.4	1.7	0
HCM LOS	F		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	854	-	183	-	-
HCM Lane V/C Ratio	0.122	-	1.853	-	-
HCM Control Delay (s)	9.8	\$	447.4	-	-
HCM Lane LOS	A	A	F	-	-
HCM 95th %tile Q(veh)	0.4	-	24.7	-	-

Notes
 -: Volume exceeds capacity \$: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

Intersection						
Int Delay, s/veh	16.9					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	Y		Y	↑	↑	
Traffic Vol, veh/h	11	321	330	484	559	26
Future Vol, veh/h	11	321	330	484	559	26
Conflicting Peds, #/hr	9	0	8	0	0	8
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	0	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	12	349	359	526	608	28

Major/Minor	Minor2	Major1	Major2			
Conflicting Flow All	1883	630	644	0	-	0
Stage 1	630	-	-	-	-	-
Stage 2	1253	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	78	482	941	-	-	-
Stage 1	531	-	-	-	-	-
Stage 2	269	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	47	478	934	-	-	-
Mov Cap-2 Maneuver	47	-	-	-	-	-
Stage 1	324	-	-	-	-	-
Stage 2	267	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	77	4.6	0
HCM LOS	F		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	934	-	367	-	-
HCM Lane V/C Ratio	0.384	-	0.983	-	-
HCM Control Delay (s)	11.2	-	77	-	-
HCM Lane LOS	B	-	F	-	-
HCM 95th %tile Q(veh)	1.8	-	11.3	-	-

Intersection						
Int Delay, s/veh	36.2					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	T			T		T
Traffic Vol, veh/h	14	338	66	813	870	10
Future Vol, veh/h	14	338	66	813	870	10
Conflicting Peds, #/hr	9	0	4	0	0	4
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	15	367	72	884	946	11

Major/Minor	Minor2	Major1	Major2			
Conflicting Flow All	1551	956	961	0	-	0
Stage 1	956	-	-	-	-	-
Stage 2	595	-	-	-	-	-
Critical Hdwy	6.63	6.23	4.13	-	-	-
Critical Hdwy Stg 1	5.43	-	-	-	-	-
Critical Hdwy Stg 2	5.83	-	-	-	-	-
Follow-up Hdwy	3.519	3.319	2.219	-	-	-
Pot Cap-1 Maneuver	114	~ 312	714	-	-	-
Stage 1	372	-	-	-	-	-
Stage 2	515	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	91	~ 311	711	-	-	-
Mov Cap-2 Maneuver	91	-	-	-	-	-
Stage 1	297	-	-	-	-	-
Stage 2	513	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	213.2	1.6	0
HCM LOS	F		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	711	-	284	-	-
HCM Lane V/C Ratio	0.101	-	1.347	-	-
HCM Control Delay (s)	10.6	0.9	213.2	-	-
HCM Lane LOS	B	A	F	-	-
HCM 95th %tile Q(veh)	0.3	-	19.6	-	-

Notes
 -: Volume exceeds capacity \$: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

HCM Unsignalized Intersection Capacity Analysis
6: Kuhio Hwy & Cane Haul Rd

Kealia Mauka Homesites
01/15/2018



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations				↕↕	↕	
Traffic Volume (veh/h)	0	0	17	935	839	401
Future Volume (Veh/h)	0	0	17	935	839	401
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)	0	0	18	1016	912	436
Pedestrians	4				9	
Lane Width (ft)	0.0				12.0	
Walking Speed (ft/s)	3.5				3.5	
Percent Blockage	0				1	
Right turn flare (veh)						
Median type				None	None	
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1687	1134	1352			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1687	1134	1352			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	100	100	96			
cM capacity (veh/h)	81	196	505			
Direction, Lane #	NB 1	NB 2	SB 1			
Volume Total	357	677	1348			
Volume Left	18	0	0			
Volume Right	0	0	436			
cSH	505	1700	1700			
Volume to Capacity	0.04	0.40	0.79			
Queue Length 95th (ft)	3	0	0			
Control Delay (s)	1.1	0.0	0.0			
Lane LOS	A					
Approach Delay (s)	0.4		0.0			
Approach LOS						
Intersection Summary						
Average Delay	0.2					
Intersection Capacity Utilization	72.1%			ICU Level of Service	C	
Analysis Period (min)	15					

Intersection

Int Delay, s/veh 16.1

Movement EBL EBR NBL NBT SBT SBR

Lane Configurations						
Traffic Vol, veh/h	285	10	4	701	740	71
Future Vol, veh/h	285	10	4	701	740	71
Conflicting Peds, #/hr	0	0	5	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	150	-	-	-
Veh in Median Storage, #	2	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	310	11	4	762	804	77

Major/Minor Minor2 Major1 Major2

Conflicting Flow All	1618	848	886	0	-	0
Stage 1	848	-	-	-	-	-
Stage 2	770	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	~ 114	361	764	-	-	-
Stage 1	420	-	-	-	-	-
Stage 2	457	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	~ 112	359	760	-	-	-
Mov Cap-2 Maneuver	~ 309	-	-	-	-	-
Stage 1	416	-	-	-	-	-
Stage 2	455	-	-	-	-	-

Approach EB NB SB

HCM Control Delay, s 98.3 0.1 0
HCM LOS F

Minor Lane/Major Mvmt NBL NBT EBLn1 SBT SBR

Capacity (veh/h)	760	-	310	-	-
HCM Lane V/C Ratio	0.006	-	1.034	-	-
HCM Control Delay (s)	9.8	-	98.3	-	-
HCM Lane LOS	A	-	F	-	-
HCM 95th %tile Q(veh)	0	-	11.7	-	-

Notes

~: Volume exceeds capacity \$: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

Intersection												
Int Delay, s/veh	1.9											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	5	2	6	5	2	55	8	644	5	69	679	4
Future Vol, veh/h	5	2	6	5	2	55	8	644	5	69	679	4
Conflicting Peds, #/hr	0	0	13	13	0	0	12	0	14	14	0	12
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None									
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	5	2	7	5	2	60	9	700	5	75	738	4

Major/Minor	Minor2		Minor1		Major1		Major2					
Conflicting Flow All	1654	1639	765	1643	1639	717	754	0	0	719	0	0
Stage 1	902	902	-	735	735	-	-	-	-	-	-	-
Stage 2	752	737	-	908	904	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	78	100	403	80	100	430	856	-	-	882	-	-
Stage 1	332	356	-	411	425	-	-	-	-	-	-	-
Stage 2	402	425	-	330	356	-	-	-	-	-	-	-
Platoon blocked, %								-	-	-	-	-
Mov Cap-1 Maneuver	57	82	393	66	82	424	846	-	-	870	-	-
Mov Cap-2 Maneuver	57	82	-	66	82	-	-	-	-	-	-	-
Stage 1	322	300	-	398	412	-	-	-	-	-	-	-
Stage 2	337	412	-	271	300	-	-	-	-	-	-	-

Approach	EB		WB		NB		SB	
HCM Control Delay, s	45.9		22.7		0.1		0.9	
HCM LOS	E		C					

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1WBLn1	SBL	SBT	SBR
Capacity (veh/h)	846	-	-	102	270	870	-
HCM Lane V/C Ratio	0.01	-	-	0.139	0.25	0.086	-
HCM Control Delay (s)	9.3	0	-	45.9	22.7	9.5	0
HCM Lane LOS	A	A	-	E	C	A	A
HCM 95th %tile Q(veh)	0	-	-	0.5	1	0.3	-

HCM Signalized Intersection Capacity Analysis

9: Kuhio Hwy & Kukui St

Kealia Mauka Homesites

01/15/2018



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕	↗			↗	↖	↖	↖		↕	
Traffic Volume (vph)	29	3	46	0	0	14	19	619	16	0	656	34
Future Volume (vph)	29	3	46	0	0	14	19	619	16	0	656	34
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1000	1900	1900	1200	1900
Total Lost time (s)		4.0	4.0			4.0	4.0	4.0			4.0	
Lane Util. Factor		1.00	1.00			1.00	1.00	1.00			1.00	
Frbp, ped/bikes		1.00	0.95			0.93	1.00	1.00			1.00	
Flpb, ped/bikes		0.97	1.00			1.00	1.00	1.00			1.00	
Frt		1.00	0.85			0.86	1.00	1.00			0.99	
Flt Protected		0.96	1.00			1.00	0.95	1.00			1.00	
Satd. Flow (prot)		1735	1500			1505	1769	800			1167	
Flt Permitted		0.96	1.00			1.00	0.34	1.00			1.00	
Satd. Flow (perm)		1735	1500			1505	629	975			1167	
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)	32	3	50	0	0	15	21	673	17	0	713	37
RTOR Reduction (vph)	0	0	47	0	0	14	0	0	0	0	1	0
Lane Group Flow (vph)	0	35	3	0	0	1	21	690	0	0	749	0
Confl. Peds. (#/hr)	6		7			6	2		13	13		2
Turn Type	Perm	NA	Perm			Perm	pm+pt	NA			NA	
Protected Phases		4					5	2			6	
Permitted Phases	4		4			8	2		6			
Actuated Green, G (s)		13.5	13.5			13.5	188.5	188.5			180.9	
Effective Green, g (s)		13.5	13.5			13.5	188.5	188.5			180.9	
Actuated g/C Ratio		0.06	0.06			0.06	0.90	0.90			0.86	
Clearance Time (s)		4.0	4.0			4.0	4.0	4.0			4.0	
Vehicle Extension (s)		3.0	3.0			3.0	3.0	3.0			3.0	
Lane Grp Cap (vph)		111	96			96	584	718			1005	
v/s Ratio Prot							0.00	c0.86			0.64	
v/s Ratio Perm		0.02	0.00			0.00	0.03					
v/c Ratio		0.32	0.03			0.01	0.04	0.96			0.75	
Uniform Delay, d1		93.8	92.1			92.0	2.2	8.0			5.6	
Progression Factor		1.00	1.00			1.00	1.00	1.00			1.00	
Incremental Delay, d2		1.6	0.1			0.0	0.0	25.2			5.0	
Delay (s)		95.5	92.3			92.0	2.2	33.2			10.7	
Level of Service		F	F			F	A	C			B	
Approach Delay (s)		93.6			92.0			32.3			10.7	
Approach LOS		F			F			C			B	

Intersection Summary

HCM 2000 Control Delay	25.8	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.94		
Actuated Cycle Length (s)	210.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	85.1%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Intersection				
Intersection Delay, s/veh	27.6			
Intersection LOS	D			
Approach	EB	WB	NB	SB
Entry Lanes	1	1	1	1
Conflicting Circle Lanes	1	1	1	1
Adj Approach Flow, veh/h	694	194	65	534
Demand Flow Rate, veh/h	708	198	66	544
Vehicles Circulating, veh/h	420	50	517	248
Vehicles Exiting, veh/h	372	533	611	0
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	46.5	5.1	6.5	13.7
Approach LOS	E	A	A	B
Lane	Left	Left	Left	Left
Designated Moves	TR	LT	LR	LTR
Assumed Moves	TR	LT	LR	LTR
RT Channelized				
Lane Util	1.000	1.000	1.000	1.000
Follow-Up Headway, s	3.186	3.186	3.186	3.186
Critical Headway, s	5.193	5.193	5.193	5.193
Entry Flow, veh/h	708	198	66	544
Cap Entry Lane, veh/h	742	1075	674	882
Entry HV Adj Factor	0.981	0.979	0.985	0.981
Flow Entry, veh/h	694	194	65	534
Cap Entry, veh/h	728	1052	664	865
V/C Ratio	0.954	0.184	0.098	0.617
Control Delay, s/veh	46.5	5.1	6.5	13.7
LOS	E	A	A	B
95th %tile Queue, veh	14	1	0	4



APPENDIX C

LEVEL OF SERVICE CALCULATIONS

- Existing PM Peak
-
-

Intersection						
Int Delay, s/veh	1.4					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	9	0	27	16	1	9
Future Vol, veh/h	9	0	27	16	1	9
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	10	0	29	17	1	10

Major/Minor	Minor1	Major1	Major2			
Conflicting Flow All	50	38	0	0	46	0
Stage 1	38	-	-	-	-	-
Stage 2	12	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	959	1034	-	-	1562	-
Stage 1	984	-	-	-	-	-
Stage 2	1011	-	-	-	-	-
Platoon blocked, %			-	-		
Mov Cap-1 Maneuver	958	1034	-	-	1562	-
Mov Cap-2 Maneuver	958	-	-	-	-	-
Stage 1	983	-	-	-	-	-
Stage 2	1011	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	8.8	0	0.7
HCM LOS	A		

Minor Lane/Major Mvmt	NBT	NBRWBLn1	SBL	SBT
Capacity (veh/h)	-	-	958	1562
HCM Lane V/C Ratio	-	-	0.01	0.001
HCM Control Delay (s)	-	-	8.8	7.3
HCM Lane LOS	-	-	A	A
HCM 95th %tile Q(veh)	-	-	0	0

Intersection												
Int Delay, s/veh	2.5											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕		↕	↕		↕	↕	
Traffic Vol, veh/h	3	0	26	26	1	7	49	623	23	19	716	8
Future Vol, veh/h	3	0	26	26	1	7	49	623	23	19	716	8
Conflicting Peds, #/hr	1	0	0	0	0	1	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None									
Storage Length	-	-	-	-	-	-	150	-	-	150	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	3	0	28	28	1	8	53	677	25	21	778	9

Major/Minor	Minor2		Minor1		Major1		Major2					
Conflicting Flow All	1626	1633	783	1635	1625	691	787	0	0	702	0	0
Stage 1	825	825	-	796	796	-	-	-	-	-	-	-
Stage 2	801	808	-	839	829	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	82	101	394	81	102	445	832	-	-	895	-	-
Stage 1	367	387	-	380	399	-	-	-	-	-	-	-
Stage 2	378	394	-	360	385	-	-	-	-	-	-	-
Platoon blocked, %								-	-	-	-	-
Mov Cap-1 Maneuver	75	92	394	70	93	445	832	-	-	895	-	-
Mov Cap-2 Maneuver	75	92	-	70	93	-	-	-	-	-	-	-
Stage 1	344	378	-	356	373	-	-	-	-	-	-	-
Stage 2	347	369	-	326	376	-	-	-	-	-	-	-

Approach	EB		WB		NB		SB	
HCM Control Delay, s	19.8		76.6		0.7		0.2	
HCM LOS	C		F					

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1WBLn1	SBL	SBT	SBR
Capacity (veh/h)	832	-	-	274	85	895	-
HCM Lane V/C Ratio	0.064	-	-	0.115	0.435	0.023	-
HCM Control Delay (s)	9.6	-	-	19.8	76.6	9.1	-
HCM Lane LOS	A	-	-	C	F	A	-
HCM 95th %tile Q(veh)	0.2	-	-	0.4	1.8	0.1	-

Intersection						
Int Delay, s/veh	12.3					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	134	36	28	588	567	154
Future Vol, veh/h	134	36	28	588	567	154
Conflicting Peds, #/hr	0	0	1	0	0	1
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	50
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	146	39	30	639	616	167

Major/Minor	Minor2	Major1	Major2			
Conflicting Flow All	1316	617	784	0	-	0
Stage 1	617	-	-	-	-	-
Stage 2	699	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	174	490	834	-	-	-
Stage 1	538	-	-	-	-	-
Stage 2	493	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	164	490	833	-	-	-
Mov Cap-2 Maneuver	164	-	-	-	-	-
Stage 1	507	-	-	-	-	-
Stage 2	493	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	107.4	0.4	0
HCM LOS	F		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	833	-	191	-	-
HCM Lane V/C Ratio	0.037	-	0.967	-	-
HCM Control Delay (s)	9.5	0	107.4	-	-
HCM Lane LOS	A	A	F	-	-
HCM 95th %tile Q(veh)	0.1	-	7.9	-	-

Intersection						
Int Delay, s/veh	4.5					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	1	211	244	610	644	13
Future Vol, veh/h	1	211	244	610	644	13
Conflicting Peds, #/hr	8	0	8	0	0	8
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	0	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	1	229	265	663	700	14

Major/Minor	Minor2	Major1	Major2			
Conflicting Flow All	1916	715	722	0	-	0
Stage 1	715	-	-	-	-	-
Stage 2	1201	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	74	431	880	-	-	-
Stage 1	485	-	-	-	-	-
Stage 2	285	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	51	428	873	-	-	-
Mov Cap-2 Maneuver	51	-	-	-	-	-
Stage 1	335	-	-	-	-	-
Stage 2	283	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	24.1	3.1	0
HCM LOS	C		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	873	-	414	-	-
HCM Lane V/C Ratio	0.304	-	0.557	-	-
HCM Control Delay (s)	10.9	-	24.1	-	-
HCM Lane LOS	B	-	C	-	-
HCM 95th %tile Q(veh)	1.3	-	3.3	-	-

Intersection						
Int Delay, s/veh	3.8					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	T			T		T
Traffic Vol, veh/h	3	156	99	852	848	15
Future Vol, veh/h	3	156	99	852	848	15
Conflicting Peds, #/hr	0	0	8	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	3	170	108	926	922	16

Major/Minor	Minor2	Major1	Major2			
Conflicting Flow All	1617	938	946	0	-	0
Stage 1	938	-	-	-	-	-
Stage 2	679	-	-	-	-	-
Critical Hdwy	6.63	6.23	4.13	-	-	-
Critical Hdwy Stg 1	5.43	-	-	-	-	-
Critical Hdwy Stg 2	5.83	-	-	-	-	-
Follow-up Hdwy	3.519	3.319	2.219	-	-	-
Pot Cap-1 Maneuver	104	320	723	-	-	-
Stage 1	380	-	-	-	-	-
Stage 2	466	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	71	318	717	-	-	-
Mov Cap-2 Maneuver	71	-	-	-	-	-
Stage 1	260	-	-	-	-	-
Stage 2	462	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	32.5	2.4	0
HCM LOS	D		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	717	-	298	-	-
HCM Lane V/C Ratio	0.15	-	0.58	-	-
HCM Control Delay (s)	10.9	1.4	32.5	-	-
HCM Lane LOS	B	A	D	-	-
HCM 95th %tile Q(veh)	0.5	-	3.4	-	-

HCM Unsignalized Intersection Capacity Analysis
6: Kuhio Hwy & Cane Haul Rd

Kealia Mauka Homesites
01/15/2018



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations				↕↕	↕	
Traffic Volume (veh/h)	0	0	14	951	696	295
Future Volume (Veh/h)	0	0	14	951	696	295
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)	0	0	15	1034	757	321
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	1464	918	1078			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1464	918	1078			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	100	100	98			
cM capacity (veh/h)	116	274	643			
Direction, Lane #	NB 1	NB 2	SB 1			
Volume Total	360	689	1078			
Volume Left	15	0	0			
Volume Right	0	0	321			
cSH	643	1700	1700			
Volume to Capacity	0.02	0.41	0.63			
Queue Length 95th (ft)	2	0	0			
Control Delay (s)	0.7	0.0	0.0			
Lane LOS	A					
Approach Delay (s)	0.3	0.0				
Approach LOS						
Intersection Summary						
Average Delay	0.1					
Intersection Capacity Utilization	57.9%		ICU Level of Service	B		
Analysis Period (min)	15					

Intersection						
Int Delay, s/veh	15.7					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↔		↔	↑	↑	
Traffic Vol, veh/h	297	9	18	664	571	151
Future Vol, veh/h	297	9	18	664	571	151
Conflicting Peds, #/hr	0	0	8	0	0	8
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	150	-	-	-
Veh in Median Storage, #	2	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	323	10	20	722	621	164

Major/Minor	Minor2	Major1	Major2			
Conflicting Flow All	1473	711	793	0	-	0
Stage 1	711	-	-	-	-	-
Stage 2	762	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	~ 140	433	828	-	-	-
Stage 1	487	-	-	-	-	-
Stage 2	461	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	~ 134	430	822	-	-	-
Mov Cap-2 Maneuver	329	-	-	-	-	-
Stage 1	471	-	-	-	-	-
Stage 2	457	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	87.1	0.3	0
HCM LOS	F		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	822	-	331	-	-
HCM Lane V/C Ratio	0.024	-	1.005	-	-
HCM Control Delay (s)	9.5	-	87.1	-	-
HCM Lane LOS	A	-	F	-	-
HCM 95th %tile Q(veh)	0.1	-	11.3	-	-

Notes
 -: Volume exceeds capacity \$: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

Intersection												
Int Delay, s/veh	2.3											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	1	1	23	5	3	94	19	597	4	36	543	15
Future Vol, veh/h	1	1	23	5	3	94	19	597	4	36	543	15
Conflicting Peds, #/hr	0	0	34	34	0	0	30	0	35	35	0	30
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None									
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	1	1	25	5	3	102	21	649	4	39	590	16

Major/Minor	Minor2		Minor1		Major1		Major2					
Conflicting Flow All	1452	1436	662	1451	1442	686	636	0	0	688	0	0
Stage 1	706	706	-	728	728	-	-	-	-	-	-	-
Stage 2	746	730	-	723	714	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	108	133	462	109	132	447	947	-	-	906	-	-
Stage 1	427	439	-	415	429	-	-	-	-	-	-	-
Stage 2	405	428	-	417	435	-	-	-	-	-	-	-
Platoon blocked, %								-	-	-	-	-
Mov Cap-1 Maneuver	72	112	434	88	112	432	920	-	-	876	-	-
Mov Cap-2 Maneuver	72	112	-	88	112	-	-	-	-	-	-	-
Stage 1	400	398	-	387	400	-	-	-	-	-	-	-
Stage 2	296	399	-	354	394	-	-	-	-	-	-	-

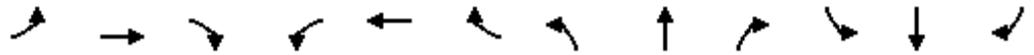
Approach	EB		WB		NB		SB	
HCM Control Delay, s	16.9		20.7		0.3		0.6	
HCM LOS	C		C					

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1WBLn1	SBL	SBT	SBR
Capacity (veh/h)	920	-	-	330	339	876	-
HCM Lane V/C Ratio	0.022	-	-	0.082	0.327	0.045	-
HCM Control Delay (s)	9	0	-	16.9	20.7	9.3	0
HCM Lane LOS	A	A	-	C	C	A	A
HCM 95th %tile Q(veh)	0.1	-	-	0.3	1.4	0.1	-

HCM Signalized Intersection Capacity Analysis
 9: Kuhio Hwy & Kukui St

Kealia Mauka Homesites

01/15/2018



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕	↗			↗	↖	↖			↕	
Traffic Volume (vph)	26	10	41	0	0	23	31	578	7	4	525	49
Future Volume (vph)	26	10	41	0	0	23	31	578	7	4	525	49
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1000	1900	1900	1200	1900
Total Lost time (s)		4.0	4.0			4.0	4.0	4.0			4.0	
Lane Util. Factor		1.00	1.00			1.00	1.00	1.00			1.00	
Frbp, ped/bikes		1.00	0.96			0.96	1.00	1.00			1.00	
Flpb, ped/bikes		0.99	1.00			1.00	1.00	1.00			1.00	
Frt		1.00	0.85			0.86	1.00	1.00			0.99	
Flt Protected		0.97	1.00			1.00	0.95	1.00			1.00	
Satd. Flow (prot)		1777	1522			1547	1769	850			1160	
Flt Permitted		0.97	1.00			1.00	0.39	1.00			1.00	
Satd. Flow (perm)		1777	1522			1547	723	978			1158	
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)	28	11	45	0	0	25	34	628	8	4	571	53
RTOR Reduction (vph)	0	0	38	0	0	21	0	0	0	0	2	0
Lane Group Flow (vph)	0	39	7	0	0	4	34	636	0	0	626	0
Confl. Peds. (#/hr)	6		7			6	2		13	13		2
Turn Type	Perm	NA	Perm			Perm	pm+pt	NA		Perm	NA	
Protected Phases		4					5	2				6
Permitted Phases	4		4			8	2		6			
Actuated Green, G (s)		17.6	17.6			17.6	94.4	94.4			86.6	
Effective Green, g (s)		17.6	17.6			17.6	94.4	94.4			86.6	
Actuated g/C Ratio		0.15	0.15			0.15	0.79	0.79			0.72	
Clearance Time (s)		4.0	4.0			4.0	4.0	4.0			4.0	
Vehicle Extension (s)		3.0	3.0			3.0	3.0	3.0			3.0	
Lane Grp Cap (vph)		260	223			226	601	668			835	
v/s Ratio Prot							0.00	c0.75				
v/s Ratio Perm		0.02	0.00			0.00	0.04				0.54	
v/c Ratio		0.15	0.03			0.02	0.06	0.95			0.75	
Uniform Delay, d1		44.7	43.9			43.8	3.5	10.9			10.1	
Progression Factor		1.00	1.00			1.00	1.00	1.00			1.00	
Incremental Delay, d2		0.3	0.1			0.0	0.0	24.8			6.1	
Delay (s)		44.9	43.9			43.8	3.5	35.6			16.2	
Level of Service		D	D			D	A	D			B	
Approach Delay (s)		44.4		43.8				34.0			16.2	
Approach LOS		D		D				C			B	
Intersection Summary												
HCM 2000 Control Delay			26.9								HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio			0.86									
Actuated Cycle Length (s)			120.0								Sum of lost time (s)	12.0
Intersection Capacity Utilization			79.9%								ICU Level of Service	D
Analysis Period (min)			15									
c Critical Lane Group												

Intersection				
Intersection Delay, s/veh	13.0			
Intersection LOS	B			
Approach	EB	WB	NB	SB
Entry Lanes	1	1	1	1
Conflicting Circle Lanes	1	1	1	1
Adj Approach Flow, veh/h	417	388	328	420
Demand Flow Rate, veh/h	425	396	335	429
Vehicles Circulating, veh/h	381	151	381	547
Vehicles Exiting, veh/h	594	565	425	0
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	13.2	8.4	10.5	19.0
Approach LOS	B	A	B	C
Lane	Left	Left	Left	Left
Designated Moves	TR	LT	LR	LTR
Assumed Moves	TR	LT	LR	LTR
RT Channelized				
Lane Util	1.000	1.000	1.000	1.000
Follow-Up Headway, s	3.186	3.186	3.186	3.186
Critical Headway, s	5.193	5.193	5.193	5.193
Entry Flow, veh/h	425	396	335	429
Cap Entry Lane, veh/h	772	972	772	654
Entry HV Adj Factor	0.981	0.979	0.979	0.978
Flow Entry, veh/h	417	388	328	420
Cap Entry, veh/h	758	951	756	640
V/C Ratio	0.551	0.408	0.434	0.656
Control Delay, s/veh	13.2	8.4	10.5	19.0
LOS	B	A	B	C
95th %tile Queue, veh	3	2	2	5



APPENDIX C

LEVEL OF SERVICE CALCULATIONS

- Base Year 2027 AM Peak
-
-

Intersection						
Int Delay, s/veh	4.2					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	Y		B			A
Traffic Vol, veh/h	20	5	5	15	5	10
Future Vol, veh/h	20	5	5	15	5	10
Conflicting Peds, #/hr	1	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	22	5	5	16	5	11

Major/Minor	Minor1	Major1	Major2			
Conflicting Flow All	35	13	0	0	21	0
Stage 1	13	-	-	-	-	-
Stage 2	22	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	978	1067	-	-	1595	-
Stage 1	1010	-	-	-	-	-
Stage 2	1001	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	974	1067	-	-	1595	-
Mov Cap-2 Maneuver	974	-	-	-	-	-
Stage 1	1007	-	-	-	-	-
Stage 2	1000	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	8.7	0	2.4
HCM LOS	A		

Minor Lane/Major Mvmt	NBT	NBRWBLn1	SBL	SBT
Capacity (veh/h)	-	-	991	1595
HCM Lane V/C Ratio	-	-	0.027	0.003
HCM Control Delay (s)	-	-	8.7	7.3
HCM Lane LOS	-	-	A	A
HCM 95th %tile Q(veh)	-	-	0.1	0

Intersection												
Int Delay, s/veh	2.8											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕		↕	↕		↕	↕	
Traffic Vol, veh/h	10	0	25	20	5	10	20	745	30	10	805	5
Future Vol, veh/h	10	0	25	20	5	10	20	745	30	10	805	5
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None									
Storage Length	-	-	-	-	-	-	150	-	-	150	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	11	0	27	22	5	11	22	810	33	11	875	5

Major/Minor	Minor2		Minor1		Major1		Major2					
Conflicting Flow All	1779	1787	878	1784	1773	827	880	0	0	843	0	0
Stage 1	900	900	-	871	871	-	-	-	-	-	-	-
Stage 2	879	887	-	913	902	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	64	81	347	63	83	371	768	-	-	793	-	-
Stage 1	333	357	-	346	368	-	-	-	-	-	-	-
Stage 2	342	362	-	328	356	-	-	-	-	-	-	-
Platoon blocked, %								-	-	-	-	-
Mov Cap-1 Maneuver	57	78	347	56	79	371	768	-	-	793	-	-
Mov Cap-2 Maneuver	57	78	-	56	79	-	-	-	-	-	-	-
Stage 1	323	352	-	336	357	-	-	-	-	-	-	-
Stage 2	318	352	-	298	351	-	-	-	-	-	-	-

Approach	EB		WB		NB		SB			
HCM Control Delay, s	39.7		88.9		0.2		0.1			
HCM LOS	E		F							

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1WBLn1	SBL	SBT	SBR
Capacity (veh/h)	768	-	-	141	78	793	-
HCM Lane V/C Ratio	0.028	-	-	0.27	0.488	0.014	-
HCM Control Delay (s)	9.8	-	-	39.7	88.9	9.6	-
HCM Lane LOS	A	-	-	E	F	A	-
HCM 95th %tile Q(veh)	0.1	-	-	1	2	0	-

Intersection			
Intersection Delay, s/veh	13.9		
Intersection LOS	B		
Approach	EB	NB	SB
Entry Lanes	1	1	1
Conflicting Circle Lanes	1	1	1
Adj Approach Flow, veh/h	430	707	907
Demand Flow Rate, veh/h	438	721	926
Vehicles Circulating, veh/h	743	277	111
Vehicles Exiting, veh/h	294	904	887
Ped Vol Crossing Leg, #/h	0	0	0
Ped Cap Adj	1.000	1.000	1.000
Approach Delay, s/veh	17.1	12.8	13.3
Approach LOS	C	B	B
Lane	Left	Left	Left
Designated Moves	LR	LT	TR
Assumed Moves	LR	LT	TR
RT Channelized			
Lane Util	1.000	1.000	1.000
Follow-Up Headway, s	2.500	2.500	2.500
Critical Headway, s	4.800	4.800	4.800
Entry Flow, veh/h	438	721	926
Cap Entry Lane, veh/h	692	1096	1291
Entry HV Adj Factor	0.982	0.981	0.980
Flow Entry, veh/h	430	707	907
Cap Entry, veh/h	679	1075	1265
V/C Ratio	0.633	0.658	0.717
Control Delay, s/veh	17.1	12.8	13.3
LOS	C	B	B
95th %tile Queue, veh	5	5	7

Intersection						
Int Delay, s/veh	14.8					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	5	260	330	580	760	30
Future Vol, veh/h	5	260	330	580	760	30
Conflicting Peds, #/hr	9	0	8	0	0	8
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	0	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	5	283	359	630	826	33

Major/Minor	Minor2	Major1	Major2			
Conflicting Flow All	2208	851	867	0	-	0
Stage 1	851	-	-	-	-	-
Stage 2	1357	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	49	360	777	-	-	-
Stage 1	419	-	-	-	-	-
Stage 2	240	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	26	357	771	-	-	-
Mov Cap-2 Maneuver	26	-	-	-	-	-
Stage 1	222	-	-	-	-	-
Stage 2	238	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	92.5	5	0
HCM LOS	F		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	771	-	288	-	-
HCM Lane V/C Ratio	0.465	-	1	-	-
HCM Control Delay (s)	13.7	-	92.5	-	-
HCM Lane LOS	B	-	F	-	-
HCM 95th %tile Q(veh)	2.5	-	10.4	-	-

Intersection						
Int Delay, s/veh	56					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	T			T		T
Traffic Vol, veh/h	10	340	70	950	1040	10
Future Vol, veh/h	10	340	70	950	1040	10
Conflicting Peds, #/hr	9	0	4	0	0	4
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	11	370	76	1033	1130	11

Major/Minor	Minor2	Major1	Major2			
Conflicting Flow All	1818	1140	1145	0	-	0
Stage 1	1140	-	-	-	-	-
Stage 2	678	-	-	-	-	-
Critical Hdwy	6.63	6.23	4.13	-	-	-
Critical Hdwy Stg 1	5.43	-	-	-	-	-
Critical Hdwy Stg 2	5.83	-	-	-	-	-
Follow-up Hdwy	3.519	3.319	2.219	-	-	-
Pot Cap-1 Maneuver	77	~ 244	608	-	-	-
Stage 1	304	-	-	-	-	-
Stage 2	467	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	54	~ 243	606	-	-	-
Mov Cap-2 Maneuver	54	-	-	-	-	-
Stage 1	214	-	-	-	-	-
Stage 2	465	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	\$ 381	2.2	0
HCM LOS	F		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	606	-	221	-	-
HCM Lane V/C Ratio	0.126	-	1.721	-	-
HCM Control Delay (s)	11.8	1.5	\$ 381	-	-
HCM Lane LOS	B	A	F	-	-
HCM 95th %tile Q(veh)	0.4	-	25.5	-	-

Notes
 -: Volume exceeds capacity \$: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

HCM Unsignalized Intersection Capacity Analysis
6: Kuhio Hwy & Cane Haul Rd



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations				↕↕	↕	
Traffic Volume (veh/h)	0	0	20	1085	995	455
Future Volume (Veh/h)	0	0	20	1085	995	455
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)	0	0	22	1179	1082	495
Pedestrians	4				9	
Lane Width (ft)	0.0				12.0	
Walking Speed (ft/s)	3.5				3.5	
Percent Blockage	0				1	
Right turn flare (veh)						
Median type				None	None	
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1976	1334	1581			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1976	1334	1581			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	100	100	95			
cM capacity (veh/h)	51	144	412			
Direction, Lane #	NB 1	NB 2	SB 1			
Volume Total	415	786	1577			
Volume Left	22	0	0			
Volume Right	0	0	495			
cSH	412	1700	1700			
Volume to Capacity	0.05	0.46	0.93			
Queue Length 95th (ft)	4	0	0			
Control Delay (s)	1.7	0.0	0.0			
Lane LOS	A					
Approach Delay (s)	0.6		0.0			
Approach LOS						
Intersection Summary						
Average Delay	0.3					
Intersection Capacity Utilization	83.6%			ICU Level of Service	E	
Analysis Period (min)	15					

Intersection						
Int Delay, s/veh	45.8					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	345	10	5	800	880	80
Future Vol, veh/h	345	10	5	800	880	80
Conflicting Peds, #/hr	0	0	5	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	150	-	-	-
Veh in Median Storage, #	2	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	375	11	5	870	957	87

Major/Minor	Minor2	Major1	Major2			
Conflicting Flow All	1886	1006	1049	0	-	0
Stage 1	1006	-	-	-	-	-
Stage 2	880	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	~ 78	293	663	-	-	-
Stage 1	~ 353	-	-	-	-	-
Stage 2	406	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	~ 77	292	660	-	-	-
Mov Cap-2 Maneuver	~ 259	-	-	-	-	-
Stage 1	~ 348	-	-	-	-	-
Stage 2	404	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	273.1	0.1	0
HCM LOS	F		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	660	-	260	-	-
HCM Lane V/C Ratio	0.008	-	1.484	-	-
HCM Control Delay (s)	10.5	-	273.1	-	-
HCM Lane LOS	B	-	F	-	-
HCM 95th %tile Q(veh)	0	-	22.2	-	-

Notes
 -: Volume exceeds capacity \$: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

Intersection												
Int Delay, s/veh	2.8											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	5	5	10	5	5	55	10	740	5	70	810	5
Future Vol, veh/h	5	5	10	5	5	55	10	740	5	70	810	5
Conflicting Peds, #/hr	0	0	13	13	0	0	12	0	14	14	0	12
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None									
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	5	5	11	5	5	60	11	804	5	76	880	5

Major/Minor	Minor2		Minor1		Major1		Major2					
Conflicting Flow All	1908	1892	908	1899	1892	821	897	0	0	823	0	0
Stage 1	1047	1047	-	843	843	-	-	-	-	-	-	-
Stage 2	861	845	-	1056	1049	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	52	70	334	53	70	374	757	-	-	807	-	-
Stage 1	276	305	-	358	380	-	-	-	-	-	-	-
Stage 2	350	379	-	272	304	-	-	-	-	-	-	-
Platoon blocked, %								-	-	-	-	-
Mov Cap-1 Maneuver	33	54	326	39	54	369	748	-	-	796	-	-
Mov Cap-2 Maneuver	33	54	-	39	54	-	-	-	-	-	-	-
Stage 1	266	245	-	344	365	-	-	-	-	-	-	-
Stage 2	281	364	-	206	244	-	-	-	-	-	-	-

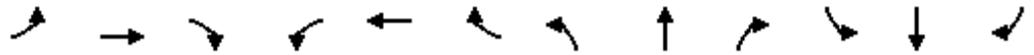
Approach	EB		WB		NB		SB	
HCM Control Delay, s	74		38.5		0.1		0.8	
HCM LOS	F		E					

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1WBLn1	SBL	SBT	SBR
Capacity (veh/h)	748	-	-	73	176	796	-
HCM Lane V/C Ratio	0.015	-	-	0.298	0.401	0.096	-
HCM Control Delay (s)	9.9	0	-	74	38.5	10	0
HCM Lane LOS	A	A	-	F	E	B	A
HCM 95th %tile Q(veh)	0	-	-	1.1	1.8	0.3	-

HCM Signalized Intersection Capacity Analysis
 9: Kuhio Hwy & Kukui St

Kealia Mauka Homesites

01/24/2018



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕	↗			↗	↖	↖			↕	
Traffic Volume (vph)	40	5	60	0	0	15	25	710	20	0	785	35
Future Volume (vph)	40	5	60	0	0	15	25	710	20	0	785	35
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1000	1900	1900	1200	1900
Total Lost time (s)		4.0	4.0			4.0	4.0	4.0			4.0	
Lane Util. Factor		1.00	1.00			1.00	1.00	1.00			1.00	
Frbp, ped/bikes		1.00	0.95			0.94	1.00	1.00			1.00	
Flpb, ped/bikes		0.97	1.00			1.00	1.00	1.00			1.00	
Frt		1.00	0.85			0.86	1.00	1.00			0.99	
Flt Protected		0.96	1.00			1.00	0.95	1.00			1.00	
Satd. Flow (prot)		1737	1500			1509	1770	800			1168	
Flt Permitted		0.96	1.00			1.00	0.28	1.00			1.00	
Satd. Flow (perm)		1737	1500			1509	518	975			1168	
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)	43	5	65	0	0	16	27	772	22	0	853	38
RTOR Reduction (vph)	0	0	61	0	0	15	0	0	0	0	1	0
Lane Group Flow (vph)	0	48	4	0	0	1	27	794	0	0	890	0
Confl. Peds. (#/hr)	6		7			6	2		13	13		2
Turn Type	Perm	NA	Perm			Perm	pm+pt	NA			NA	
Protected Phases		4					5	2			6	
Permitted Phases	4		4			8	2		6			
Actuated Green, G (s)		14.3	14.3			14.3	187.7	187.7			178.9	
Effective Green, g (s)		14.3	14.3			14.3	187.7	187.7			178.9	
Actuated g/C Ratio		0.07	0.07			0.07	0.89	0.89			0.85	
Clearance Time (s)		4.0	4.0			4.0	4.0	4.0			4.0	
Vehicle Extension (s)		3.0	3.0			3.0	3.0	3.0			3.0	
Lane Grp Cap (vph)		118	102			102	491	715			995	
v/s Ratio Prot							0.00	c0.99			0.76	
v/s Ratio Perm		0.03	0.00			0.00	0.05					
v/c Ratio		0.41	0.04			0.01	0.05	1.11			0.89	
Uniform Delay, d1		93.8	91.5			91.3	3.5	11.2			9.7	
Progression Factor		1.00	1.00			1.00	1.00	1.00			1.00	
Incremental Delay, d2		2.3	0.2			0.0	0.0	68.0			12.2	
Delay (s)		96.1	91.6			91.3	3.6	79.2			21.9	
Level of Service		F	F			F	A	E			C	
Approach Delay (s)		93.5		91.3				76.7			21.9	
Approach LOS		F		F				E			C	
Intersection Summary												
HCM 2000 Control Delay			51.3								HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio			1.08									
Actuated Cycle Length (s)			210.0								Sum of lost time (s)	12.0
Intersection Capacity Utilization			94.6%								ICU Level of Service	F
Analysis Period (min)			15									
c Critical Lane Group												

Intersection				
Intersection Delay, s/veh	14.6			
Intersection LOS	B			
Approach	EB	WB	NB	SB
Entry Lanes	1	1	1	1
Conflicting Circle Lanes	1	1	1	1
Adj Approach Flow, veh/h	669	250	44	581
Demand Flow Rate, veh/h	682	255	44	592
Vehicles Circulating, veh/h	460	22	632	277
Vehicles Exiting, veh/h	409	654	510	0
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	22.1	4.3	5.6	10.9
Approach LOS	C	A	A	B
Lane	Left	Left	Left	Left
Designated Moves	TR	LT	LR	LTR
Assumed Moves	TR	LT	LR	LTR
RT Channelized				
Lane Util	1.000	1.000	1.000	1.000
Follow-Up Headway, s	2.609	2.609	2.609	2.609
Critical Headway, s	4.976	4.976	4.976	4.976
Entry Flow, veh/h	682	255	44	592
Cap Entry Lane, veh/h	863	1349	724	1040
Entry HV Adj Factor	0.981	0.979	1.000	0.982
Flow Entry, veh/h	669	250	44	581
Cap Entry, veh/h	847	1322	724	1021
V/C Ratio	0.790	0.189	0.061	0.569
Control Delay, s/veh	22.1	4.3	5.6	10.9
LOS	C	A	A	B
95th %tile Queue, veh	8	1	0	4



APPENDIX C

LEVEL OF SERVICE CALCULATIONS

- Base Year 2027 PM Peak
-
-

Intersection						
Int Delay, s/veh	1.7					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	W		T			T
Traffic Vol, veh/h	10	0	30	20	5	10
Future Vol, veh/h	10	0	30	20	5	10
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	11	0	33	22	5	11

Major/Minor	Minor1	Major1	Major2			
Conflicting Flow All	65	44	0	0	55	0
Stage 1	44	-	-	-	-	-
Stage 2	21	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	941	1026	-	-	1550	-
Stage 1	978	-	-	-	-	-
Stage 2	1002	-	-	-	-	-
Platoon blocked, %			-	-	-	-
Mov Cap-1 Maneuver	938	1026	-	-	1550	-
Mov Cap-2 Maneuver	938	-	-	-	-	-
Stage 1	975	-	-	-	-	-
Stage 2	1002	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	8.9	0	2.4
HCM LOS	A		

Minor Lane/Major Mvmt	NBT	NBRWBLn1	SBL	SBT
Capacity (veh/h)	-	-	938	1550
HCM Lane V/C Ratio	-	-	0.012	0.004
HCM Control Delay (s)	-	-	8.9	7.3
HCM Lane LOS	-	-	A	A
HCM 95th %tile Q(veh)	-	-	0	0

Intersection												
Int Delay, s/veh	8.6											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕		↕	↕		↕	↕	
Traffic Vol, veh/h	5	0	30	30	5	10	50	810	25	20	905	10
Future Vol, veh/h	5	0	30	30	5	10	50	810	25	20	905	10
Conflicting Peds, #/hr	1	0	0	0	0	1	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None									
Storage Length	-	-	-	-	-	-	150	-	-	150	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	5	0	33	33	5	11	54	880	27	22	984	11

Major/Minor	Minor2		Minor1		Major1		Major2					
Conflicting Flow All	2045	2049	990	2052	2041	895	995	0	0	907	0	0
Stage 1	1034	1034	-	1002	1002	-	-	-	-	-	-	-
Stage 2	1011	1015	-	1050	1039	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	41	56	299	41	56	339	695	-	-	750	-	-
Stage 1	280	309	-	292	320	-	-	-	-	-	-	-
Stage 2	289	316	-	275	308	-	-	-	-	-	-	-
Platoon blocked, %								-	-	-	-	-
Mov Cap-1 Maneuver	33	50	299	34	50	339	695	-	-	750	-	-
Mov Cap-2 Maneuver	33	50	-	34	50	-	-	-	-	-	-	-
Stage 1	258	300	-	269	295	-	-	-	-	-	-	-
Stage 2	253	291	-	238	299	-	-	-	-	-	-	-

Approach	EB		WB		NB		SB	
HCM Control Delay, s	40.4		\$ 315.8		0.6		0.2	
HCM LOS	E		F					

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	695	-	-	139	44	750	-	-
HCM Lane V/C Ratio	0.078	-	-	0.274	1.112	0.029	-	-
HCM Control Delay (s)	10.6	-	-	40.4	\$ 315.8	9.9	-	-
HCM Lane LOS	B	-	-	E	F	A	-	-
HCM 95th %tile Q(veh)	0.3	-	-	1	4.6	0.1	-	-

Notes			
-:	Volume exceeds capacity	\$:	Delay exceeds 300s
+	Computation Not Defined	*	All major volume in platoon

Intersection			
Intersection Delay, s/veh	12.8		
Intersection LOS	B		
Approach	EB	NB	SB
Entry Lanes	1	1	1
Conflicting Circle Lanes	1	1	1
Adj Approach Flow, veh/h	239	870	972
Demand Flow Rate, veh/h	244	888	991
Vehicles Circulating, veh/h	820	155	34
Vehicles Exiting, veh/h	205	909	1009
Ped Vol Crossing Leg, #/h	1	0	0
Ped Cap Adj	1.000	1.000	1.000
Approach Delay, s/veh	11.1	13.7	12.4
Approach LOS	B	B	B
Lane	Left	Left	Left
Designated Moves	LR	LT	TR
Assumed Moves	LR	LT	TR
RT Channelized			
Lane Util	1.000	1.000	1.000
Follow-Up Headway, s	2.500	2.500	2.500
Critical Headway, s	4.800	4.800	4.800
Entry Flow, veh/h	244	888	991
Cap Entry Lane, veh/h	641	1236	1393
Entry HV Adj Factor	0.980	0.980	0.981
Flow Entry, veh/h	239	870	972
Cap Entry, veh/h	628	1211	1366
V/C Ratio	0.380	0.719	0.712
Control Delay, s/veh	11.1	13.7	12.4
LOS	B	B	B
95th %tile Queue, veh	2	7	7

Intersection						
Int Delay, s/veh	4.2					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	0	170	245	795	865	15
Future Vol, veh/h	0	170	245	795	865	15
Conflicting Peds, #/hr	8	0	8	0	0	8
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	0	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	185	266	864	940	16

Major/Minor	Minor2	Major1	Major2			
Conflicting Flow All	2360	956	964	0	-	0
Stage 1	956	-	-	-	-	-
Stage 2	1404	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	39	313	714	-	-	-
Stage 1	373	-	-	-	-	-
Stage 2	227	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	24	311	709	-	-	-
Mov Cap-2 Maneuver	24	-	-	-	-	-
Stage 1	231	-	-	-	-	-
Stage 2	225	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	32.2	3.1	0
HCM LOS	D		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	709	-	311	-	-
HCM Lane V/C Ratio	0.376	-	0.594	-	-
HCM Control Delay (s)	13.1	-	32.2	-	-
HCM Lane LOS	B	-	D	-	-
HCM 95th %tile Q(veh)	1.7	-	3.6	-	-

Intersection						
Int Delay, s/veh	8.2					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	T			T		T
Traffic Vol, veh/h	5	160	100	1065	1050	15
Future Vol, veh/h	5	160	100	1065	1050	15
Conflicting Peds, #/hr	0	0	8	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	5	174	109	1158	1141	16

Major/Minor	Minor2	Major1	Major2			
Conflicting Flow All	1954	1157	1165	0	-	0
Stage 1	1157	-	-	-	-	-
Stage 2	797	-	-	-	-	-
Critical Hdwy	6.63	6.23	4.13	-	-	-
Critical Hdwy Stg 1	5.43	-	-	-	-	-
Critical Hdwy Stg 2	5.83	-	-	-	-	-
Follow-up Hdwy	3.519	3.319	2.219	-	-	-
Pot Cap-1 Maneuver	63	238	598	-	-	-
Stage 1	298	-	-	-	-	-
Stage 2	405	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	30	236	593	-	-	-
Mov Cap-2 Maneuver	30	-	-	-	-	-
Stage 1	143	-	-	-	-	-
Stage 2	402	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	94.7	3.5	0
HCM LOS	F		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	593	-	195	-	-
HCM Lane V/C Ratio	0.183	-	0.92	-	-
HCM Control Delay (s)	12.4	2.7	94.7	-	-
HCM Lane LOS	B	A	F	-	-
HCM 95th %tile Q(veh)	0.7	-	7.3	-	-

HCM Unsignalized Intersection Capacity Analysis
6: Kuhio Hwy & Cane Haul Rd

Kealia Mauka Homesites
01/24/2018



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations				↕↕	↔	
Traffic Volume (veh/h)	0	0	15	1170	850	360
Future Volume (Veh/h)	0	0	15	1170	850	360
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)	0	0	16	1272	924	391
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	1788	1120	1315			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1788	1120	1315			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	100	100	97			
cM capacity (veh/h)	70	201	522			
Direction, Lane #	NB 1	NB 2	SB 1			
Volume Total	440	848	1315			
Volume Left	16	0	0			
Volume Right	0	0	391			
cSH	522	1700	1700			
Volume to Capacity	0.03	0.50	0.77			
Queue Length 95th (ft)	2	0	0			
Control Delay (s)	0.9	0.0	0.0			
Lane LOS	A					
Approach Delay (s)	0.3		0.0			
Approach LOS						
Intersection Summary						
Average Delay	0.2					
Intersection Capacity Utilization	70.0%		ICU Level of Service	C		
Analysis Period (min)	15					

Intersection						
Int Delay, s/veh	54					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	Y		Y	↑	↑	
Traffic Vol, veh/h	370	10	20	815	695	175
Future Vol, veh/h	370	10	20	815	695	175
Conflicting Peds, #/hr	0	0	8	0	0	8
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	150	-	-	-
Veh in Median Storage, #	2	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	402	11	22	886	755	190

Major/Minor	Minor2	Major1	Major2			
Conflicting Flow All	1788	858	953	0	-	0
Stage 1	858	-	-	-	-	-
Stage 2	930	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	~ 89	357	721	-	-	-
Stage 1	415	-	-	-	-	-
Stage 2	~ 384	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	~ 85	354	716	-	-	-
Mov Cap-2 Maneuver	~ 266	-	-	-	-	-
Stage 1	~ 399	-	-	-	-	-
Stage 2	~ 381	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	295.6	0.2	0
HCM LOS	F		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	716	-	268	-	-
HCM Lane V/C Ratio	0.03	-	1.541	-	-
HCM Control Delay (s)	10.2	-	295.6	-	-
HCM Lane LOS	B	-	F	-	-
HCM 95th %tile Q(veh)	0.1	-	24.5	-	-

Notes
 -: Volume exceeds capacity \$: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

Intersection												
Int Delay, s/veh	3.5											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	5	5	25	5	5	95	20	740	5	40	660	15
Future Vol, veh/h	5	5	25	5	5	95	20	740	5	40	660	15
Conflicting Peds, #/hr	0	0	34	34	0	0	30	0	35	35	0	30
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None									
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	5	5	27	5	5	103	22	804	5	43	717	16

Major/Minor	Minor2		Minor1		Major1		Major2					
Conflicting Flow All	1746	1729	789	1747	1735	842	763	0	0	844	0	0
Stage 1	841	841	-	886	886	-	-	-	-	-	-	-
Stage 2	905	888	-	861	849	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	68	88	391	67	88	364	850	-	-	792	-	-
Stage 1	359	380	-	339	363	-	-	-	-	-	-	-
Stage 2	331	362	-	350	377	-	-	-	-	-	-	-
Platoon blocked, %								-	-	-	-	-
Mov Cap-1 Maneuver	39	71	368	49	71	352	826	-	-	766	-	-
Mov Cap-2 Maneuver	39	71	-	49	71	-	-	-	-	-	-	-
Stage 1	332	334	-	312	334	-	-	-	-	-	-	-
Stage 2	219	333	-	279	331	-	-	-	-	-	-	-

Approach	EB		WB		NB		SB			
HCM Control Delay, s	43.4		33.5		0.2		0.6			
HCM LOS	E		D							

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1WBLn1	SBL	SBT	SBR
Capacity (veh/h)	826	-	-	131	237	766	-
HCM Lane V/C Ratio	0.026	-	-	0.29	0.482	0.057	-
HCM Control Delay (s)	9.5	0	-	43.4	33.5	10	0
HCM Lane LOS	A	A	-	E	D	A	A
HCM 95th %tile Q(veh)	0.1	-	-	1.1	2.4	0.2	-

HCM Signalized Intersection Capacity Analysis

9: Kuhio Hwy & Kukui St

Kealia Mauka Homesites

01/24/2018



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations		↕	↗			↗	↖	↖			↕		
Traffic Volume (vph)	35	15	60	0	0	25	35	715	10	5	640	55	
Future Volume (vph)	35	15	60	0	0	25	35	715	10	5	640	55	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1000	1900	1900	1200	1900	
Total Lost time (s)		4.0	4.0			4.0	4.0	4.0			4.0		
Lane Util. Factor		1.00	1.00			1.00	1.00	1.00			1.00		
Frbp, ped/bikes		1.00	0.95			0.95	1.00	1.00			1.00		
Flpb, ped/bikes		0.98	1.00			1.00	1.00	1.00			1.00		
Frt		1.00	0.85			0.86	1.00	1.00			0.99		
Flt Protected		0.97	1.00			1.00	0.95	1.00			1.00		
Satd. Flow (prot)		1768	1507			1534	1769	850			1161		
Flt Permitted		0.97	1.00			1.00	0.35	1.00			1.00		
Satd. Flow (perm)		1768	1507			1534	660	978			1156		
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	16	65	0	0	27	38	777	11	5	696	60	
RTOR Reduction (vph)	0	0	58	0	0	24	0	0	0	0	1	0	
Lane Group Flow (vph)	0	54	7	0	0	3	38	788	0	0	760	0	
Confl. Peds. (#/hr)	6		7			6	2		13	13		2	
Turn Type	Perm	NA	Perm			Perm	pm+pt	NA		Perm	NA		
Protected Phases		4					5	2				6	
Permitted Phases	4		4			8	2		6				
Actuated Green, G (s)		18.9	18.9			18.9	153.1	153.1			144.1		
Effective Green, g (s)		18.9	18.9			18.9	153.1	153.1			144.1		
Actuated g/C Ratio		0.10	0.10			0.10	0.85	0.85			0.80		
Clearance Time (s)		4.0	4.0			4.0	4.0	4.0			4.0		
Vehicle Extension (s)		3.0	3.0			3.0	3.0	3.0			3.0		
Lane Grp Cap (vph)		185	158			161	592	722			925		
v/s Ratio Prot							0.00	c0.93					
v/s Ratio Perm		0.03	0.00			0.00	0.05				0.66		
v/c Ratio		0.29	0.04			0.02	0.06	1.09			0.82		
Uniform Delay, d1		74.4	72.4			72.2	2.7	13.5			10.5		
Progression Factor		1.00	1.00			1.00	1.00	1.00			1.00		
Incremental Delay, d2		0.9	0.1			0.0	0.0	61.1			8.1		
Delay (s)		75.3	72.5			72.3	2.7	74.5			18.6		
Level of Service		E	E			E	A	E			B		
Approach Delay (s)		73.8			72.3			71.2			18.6		
Approach LOS		E			E			E			B		
Intersection Summary													
HCM 2000 Control Delay			48.3									HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio			1.03										
Actuated Cycle Length (s)			180.0									Sum of lost time (s)	12.0
Intersection Capacity Utilization			94.0%									ICU Level of Service	F
Analysis Period (min)			15										
c Critical Lane Group													

Intersection				
Intersection Delay, s/veh	10.9			
Intersection LOS	B			
Approach	EB	WB	NB	SB
Entry Lanes	1	1	1	1
Conflicting Circle Lanes	1	1	1	1
Adj Approach Flow, veh/h	451	511	266	479
Demand Flow Rate, veh/h	460	522	272	489
Vehicles Circulating, veh/h	412	78	500	600
Vehicles Exiting, veh/h	677	694	372	0
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	10.7	6.9	8.2	16.9
Approach LOS	B	A	A	C
Lane	Left	Left	Left	Left
Designated Moves	TR	LT	LR	LTR
Assumed Moves	TR	LT	LR	LTR
RT Channelized				
Lane Util	1.000	1.000	1.000	1.000
Follow-Up Headway, s	2.609	2.609	2.609	2.609
Critical Headway, s	4.976	4.976	4.976	4.976
Entry Flow, veh/h	460	522	272	489
Cap Entry Lane, veh/h	906	1274	829	748
Entry HV Adj Factor	0.980	0.980	0.978	0.980
Flow Entry, veh/h	451	511	266	479
Cap Entry, veh/h	888	1248	810	733
V/C Ratio	0.507	0.410	0.328	0.653
Control Delay, s/veh	10.7	6.9	8.2	16.9
LOS	B	A	A	C
95th %tile Queue, veh	3	2	1	5



APPENDIX C

LEVEL OF SERVICE CALCULATIONS

- Base Year 2027 with Mitigation (Without Bypass) AM Peak
-
-

Intersection						
Int Delay, s/veh	4.2					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	20	5	5	15	5	10
Future Vol, veh/h	20	5	5	15	5	10
Conflicting Peds, #/hr	1	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	22	5	5	16	5	11

Major/Minor	Minor1	Major1	Major2			
Conflicting Flow All	35	13	0	0	21	0
Stage 1	13	-	-	-	-	-
Stage 2	22	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	978	1067	-	-	1595	-
Stage 1	1010	-	-	-	-	-
Stage 2	1001	-	-	-	-	-
Platoon blocked, %			-	-	-	-
Mov Cap-1 Maneuver	974	1067	-	-	1595	-
Mov Cap-2 Maneuver	974	-	-	-	-	-
Stage 1	1007	-	-	-	-	-
Stage 2	1000	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	8.7	0	2.4
HCM LOS	A		

Minor Lane/Major Mvmt	NBT	NBRWBLn1	SBL	SBT
Capacity (veh/h)	-	-	991	1595
HCM Lane V/C Ratio	-	-	0.027	0.003
HCM Control Delay (s)	-	-	8.7	7.3
HCM Lane LOS	-	-	A	A
HCM 95th %tile Q(veh)	-	-	0.1	0

Intersection												
Int Delay, s/veh	2.8											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕		↕	↕		↕	↕	
Traffic Vol, veh/h	10	0	25	20	5	10	20	745	30	10	805	5
Future Vol, veh/h	10	0	25	20	5	10	20	745	30	10	805	5
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None									
Storage Length	-	-	-	-	-	-	150	-	-	150	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	11	0	27	22	5	11	22	810	33	11	875	5

Major/Minor	Minor2		Minor1		Major1		Major2					
Conflicting Flow All	1779	1787	878	1784	1773	827	880	0	0	843	0	0
Stage 1	900	900	-	871	871	-	-	-	-	-	-	-
Stage 2	879	887	-	913	902	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	64	81	347	63	83	371	768	-	-	793	-	-
Stage 1	333	357	-	346	368	-	-	-	-	-	-	-
Stage 2	342	362	-	328	356	-	-	-	-	-	-	-
Platoon blocked, %								-	-	-	-	-
Mov Cap-1 Maneuver	57	78	347	56	79	371	768	-	-	793	-	-
Mov Cap-2 Maneuver	57	78	-	56	79	-	-	-	-	-	-	-
Stage 1	323	352	-	336	357	-	-	-	-	-	-	-
Stage 2	318	352	-	298	351	-	-	-	-	-	-	-

Approach	EB		WB		NB		SB			
HCM Control Delay, s	39.7		88.9		0.2		0.1			
HCM LOS	E		F							

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1WBLn1	SBL	SBT	SBR
Capacity (veh/h)	768	-	-	141	78	793	-
HCM Lane V/C Ratio	0.028	-	-	0.27	0.488	0.014	-
HCM Control Delay (s)	9.8	-	-	39.7	88.9	9.6	-
HCM Lane LOS	A	-	-	E	F	A	-
HCM 95th %tile Q(veh)	0.1	-	-	1	2	0	-

Intersection			
Intersection Delay, s/veh	15.3		
Intersection LOS	C		
Approach	EB	NB	SB
Entry Lanes	1	1	1
Conflicting Circle Lanes	1	1	1
Adj Approach Flow, veh/h	500	707	907
Demand Flow Rate, veh/h	510	721	926
Vehicles Circulating, veh/h	743	277	111
Vehicles Exiting, veh/h	294	976	887
Ped Vol Crossing Leg, #/h	0	0	0
Ped Cap Adj	1.000	1.000	1.000
Approach Delay, s/veh	22.3	12.8	13.3
Approach LOS	C	B	B
Lane	Left	Left	Left
Designated Moves	LR	LT	TR
Assumed Moves	LR	LT	TR
RT Channelized			
Lane Util	1.000	1.000	1.000
Follow-Up Headway, s	2.500	2.500	2.500
Critical Headway, s	4.800	4.800	4.800
Entry Flow, veh/h	510	721	926
Cap Entry Lane, veh/h	692	1096	1291
Entry HV Adj Factor	0.980	0.981	0.980
Flow Entry, veh/h	500	707	907
Cap Entry, veh/h	679	1075	1265
V/C Ratio	0.737	0.658	0.717
Control Delay, s/veh	22.3	12.8	13.3
LOS	C	B	B
95th %tile Queue, veh	7	5	7

Intersection						
Int Delay, s/veh	19.9					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↔		↔	↑	↑	
Traffic Vol, veh/h	5	260	330	580	830	30
Future Vol, veh/h	5	260	330	580	830	30
Conflicting Peds, #/hr	9	0	8	0	0	8
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	0	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	5	283	359	630	902	33

Major/Minor	Minor2	Major1	Major2			
Conflicting Flow All	2284	927	943	0	-	0
Stage 1	927	-	-	-	-	-
Stage 2	1357	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	44	325	727	-	-	-
Stage 1	385	-	-	-	-	-
Stage 2	240	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	22	323	721	-	-	-
Mov Cap-2 Maneuver	22	-	-	-	-	-
Stage 1	192	-	-	-	-	-
Stage 2	238	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	134.5	5.4	0
HCM LOS	F		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	721	-	257	-	-
HCM Lane V/C Ratio	0.497	-	1.121	-	-
HCM Control Delay (s)	14.8	-	134.5	-	-
HCM Lane LOS	B	-	F	-	-
HCM 95th %tile Q(veh)	2.8	-	12.5	-	-

Intersection						
Int Delay, s/veh	38.4					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	T			T		T
Traffic Vol, veh/h	10	270	70	950	1110	10
Future Vol, veh/h	10	270	70	950	1110	10
Conflicting Peds, #/hr	9	0	4	0	0	4
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	11	293	76	1033	1207	11

Major/Minor	Minor2	Major1	Major2			
Conflicting Flow All	1895	1217	1222	0	-	0
Stage 1	1217	-	-	-	-	-
Stage 2	678	-	-	-	-	-
Critical Hdwy	6.63	6.23	4.13	-	-	-
Critical Hdwy Stg 1	5.43	-	-	-	-	-
Critical Hdwy Stg 2	5.83	-	-	-	-	-
Follow-up Hdwy	3.519	3.319	2.219	-	-	-
Pot Cap-1 Maneuver	69	~ 220	568	-	-	-
Stage 1	279	-	-	-	-	-
Stage 2	467	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	47	~ 219	566	-	-	-
Mov Cap-2 Maneuver	47	-	-	-	-	-
Stage 1	190	-	-	-	-	-
Stage 2	465	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s\$	323.2	2.4	0
HCM LOS	F		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	566	-	194	-	-
HCM Lane V/C Ratio	0.134	-	1.569	-	-
HCM Control Delay (s)	12.3	1.7\$	323.2	-	-
HCM Lane LOS	B	A	F	-	-
HCM 95th %tile Q(veh)	0.5	-	19.6	-	-

Notes
 -: Volume exceeds capacity \$: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

HCM Unsignalized Intersection Capacity Analysis
6: Kuhio Hwy & Cane Haul Rd

Kealia Mauka Homesites
01/24/2018



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations				↕↕	↕	
Traffic Volume (veh/h)	0	0	20	1085	995	455
Future Volume (Veh/h)	0	0	20	1085	995	455
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)	0	0	22	1179	1082	495
Pedestrians	4				9	
Lane Width (ft)	0.0				12.0	
Walking Speed (ft/s)	3.5				3.5	
Percent Blockage	0				1	
Right turn flare (veh)						
Median type				None	None	
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1976	1334	1581			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1976	1334	1581			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	100	100	95			
cM capacity (veh/h)	51	144	412			
Direction, Lane #	NB 1	NB 2	SB 1			
Volume Total	415	786	1577			
Volume Left	22	0	0			
Volume Right	0	0	495			
cSH	412	1700	1700			
Volume to Capacity	0.05	0.46	0.93			
Queue Length 95th (ft)	4	0	0			
Control Delay (s)	1.7	0.0	0.0			
Lane LOS	A					
Approach Delay (s)	0.6		0.0			
Approach LOS						
Intersection Summary						
Average Delay			0.3			
Intersection Capacity Utilization			83.6%	ICU Level of Service	E	
Analysis Period (min)			15			

Intersection						
Int Delay, s/veh	8.7					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	Y		Y	↑	↑	
Traffic Vol, veh/h	195	10	5	950	880	80
Future Vol, veh/h	195	10	5	950	880	80
Conflicting Peds, #/hr	0	0	5	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	150	-	-	-
Veh in Median Storage, #	2	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	212	11	5	1033	957	87

Major/Minor	Minor2	Major1	Major2			
Conflicting Flow All	2049	1006	1049	0	-	0
Stage 1	1006	-	-	-	-	-
Stage 2	1043	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	~ 61	293	663	-	-	-
Stage 1	353	-	-	-	-	-
Stage 2	339	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	~ 60	292	660	-	-	-
Mov Cap-2 Maneuver	234	-	-	-	-	-
Stage 1	348	-	-	-	-	-
Stage 2	337	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	89.2	0.1	0
HCM LOS	F		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	660	-	236	-	-
HCM Lane V/C Ratio	0.008	-	0.944	-	-
HCM Control Delay (s)	10.5	-	89.2	-	-
HCM Lane LOS	B	-	F	-	-
HCM 95th %tile Q(veh)	0	-	8.4	-	-

Notes
 -: Volume exceeds capacity \$: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

Intersection												
Int Delay, s/veh	10.3											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	115	5	10	5	5	65	10	770	15	70	810	5
Future Vol, veh/h	115	5	10	5	5	65	10	770	15	70	810	5
Conflicting Peds, #/hr	0	0	13	13	0	0	12	0	14	14	0	12
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None									
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	2	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	125	5	11	5	5	71	11	837	16	76	880	5

Major/Minor	Minor2		Minor1		Major1		Major2					
Conflicting Flow All	1952	1936	908	1937	1930	859	897	0	0	867	0	0
Stage 1	1047	1047	-	881	881	-	-	-	-	-	-	-
Stage 2	905	889	-	1056	1049	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	~ 48	66	334	49	66	356	757	-	-	777	-	-
Stage 1	276	305	-	341	365	-	-	-	-	-	-	-
Stage 2	331	361	-	272	304	-	-	-	-	-	-	-
Platoon blocked, %								-	-	-	-	-
Mov Cap-1 Maneuver	~ 29	50	326	38	50	351	748	-	-	767	-	-
Mov Cap-2 Maneuver	141	177	-	38	50	-	-	-	-	-	-	-
Stage 1	265	243	-	327	350	-	-	-	-	-	-	-
Stage 2	253	346	-	204	242	-	-	-	-	-	-	-

Approach	EB		WB		NB		SB	
HCM Control Delay, s	119.7		40.6		0.1		0.8	
HCM LOS	F		E					

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1WBLn1	SBL	SBT	SBR
Capacity (veh/h)	748	-	-	149	180	767	-
HCM Lane V/C Ratio	0.015	-	-	0.948	0.453	0.099	-
HCM Control Delay (s)	9.9	0	-	119.7	40.6	10.2	0
HCM Lane LOS	A	A	-	F	E	B	A
HCM 95th %tile Q(veh)	0	-	-	6.8	2.1	0.3	-

Notes
 -: Volume exceeds capacity \$: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

HCM Signalized Intersection Capacity Analysis

9: Kuhio Hwy & Kukui St

Kealia Mauka Homesites

01/24/2018



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	80	65	25	725	785	35
Future Volume (vph)	80	65	25	725	785	35
Ideal Flow (vphpl)	1900	1900	1900	1000	1200	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	
Frpb, ped/bikes	1.00	0.95	1.00	1.00	1.00	
Flpb, ped/bikes	0.98	1.00	1.00	1.00	1.00	
Frt	1.00	0.85	1.00	1.00	0.99	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1726	1507	1770	800	1168	
Flt Permitted	0.95	1.00	0.27	1.00	1.00	
Satd. Flow (perm)	1726	1507	495	980	1168	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	87	71	27	788	853	38
RTOR Reduction (vph)	0	65	0	0	1	0
Lane Group Flow (vph)	87	6	27	788	890	0
Confl. Peds. (#/hr)	6	7	2			2
Turn Type	Perm	Perm	pm+pt	NA	NA	
Protected Phases			5	2	6	
Permitted Phases	4	4	2			
Actuated Green, G (s)	14.8	14.8	157.2	157.2	148.4	
Effective Green, g (s)	14.8	14.8	157.2	157.2	148.4	
Actuated g/C Ratio	0.08	0.08	0.87	0.87	0.82	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	141	123	466	698	962	
v/s Ratio Prot			0.00	c0.98	0.76	
v/s Ratio Perm	c0.05	0.00	0.05			
v/c Ratio	0.62	0.05	0.06	1.13	0.93	
Uniform Delay, d1	79.9	76.1	4.3	11.4	11.7	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	7.8	0.2	0.1	75.4	15.8	
Delay (s)	87.7	76.3	4.3	86.8	27.5	
Level of Service	F	E	A	F	C	
Approach Delay (s)	82.5			84.1	27.5	
Approach LOS	F			F	C	

Intersection Summary

HCM 2000 Control Delay	56.9	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.11		
Actuated Cycle Length (s)	180.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	86.5%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Intersection				
Intersection Delay, s/veh	14.6			
Intersection LOS	B			
Approach	EB	WB	NB	SB
Entry Lanes	1	1	1	1
Conflicting Circle Lanes	1	1	1	1
Adj Approach Flow, veh/h	669	250	44	581
Demand Flow Rate, veh/h	682	255	44	592
Vehicles Circulating, veh/h	460	22	632	277
Vehicles Exiting, veh/h	409	654	510	0
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	22.1	4.3	5.6	10.9
Approach LOS	C	A	A	B
Lane	Left	Left	Left	Left
Designated Moves	TR	LT	LR	LTR
Assumed Moves	TR	LT	LR	LTR
RT Channelized				
Lane Util	1.000	1.000	1.000	1.000
Follow-Up Headway, s	2.609	2.609	2.609	2.609
Critical Headway, s	4.976	4.976	4.976	4.976
Entry Flow, veh/h	682	255	44	592
Cap Entry Lane, veh/h	863	1349	724	1040
Entry HV Adj Factor	0.981	0.979	1.000	0.982
Flow Entry, veh/h	669	250	44	581
Cap Entry, veh/h	847	1322	724	1021
V/C Ratio	0.790	0.189	0.061	0.569
Control Delay, s/veh	22.1	4.3	5.6	10.9
LOS	C	A	A	B
95th %tile Queue, veh	8	1	0	4



APPENDIX C

LEVEL OF SERVICE CALCULATIONS

- Base Year 2027 with Mitigation (Without Bypass) PM Peak
-
-

Intersection						
Int Delay, s/veh	1.7					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	10	0	30	20	5	10
Future Vol, veh/h	10	0	30	20	5	10
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	11	0	33	22	5	11

Major/Minor	Minor1	Major1	Major2		
Conflicting Flow All	65	44	0	0	55
Stage 1	44	-	-	-	-
Stage 2	21	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12
Critical Hdwy Stg 1	5.42	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218
Pot Cap-1 Maneuver	941	1026	-	-	1550
Stage 1	978	-	-	-	-
Stage 2	1002	-	-	-	-
Platoon blocked, %			-	-	-
Mov Cap-1 Maneuver	938	1026	-	-	1550
Mov Cap-2 Maneuver	938	-	-	-	-
Stage 1	975	-	-	-	-
Stage 2	1002	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	8.9	0	2.4
HCM LOS	A		

Minor Lane/Major Mvmt	NBT	NBRWBLn1	SBL	SBT
Capacity (veh/h)	-	-	938	1550
HCM Lane V/C Ratio	-	-	0.012	0.004
HCM Control Delay (s)	-	-	8.9	7.3
HCM Lane LOS	-	-	A	A
HCM 95th %tile Q(veh)	-	-	0	0

Intersection												
Int Delay, s/veh	8.6											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕		↕	↕		↕	↕	
Traffic Vol, veh/h	5	0	30	30	5	10	50	810	25	20	905	10
Future Vol, veh/h	5	0	30	30	5	10	50	810	25	20	905	10
Conflicting Peds, #/hr	1	0	0	0	0	1	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None									
Storage Length	-	-	-	-	-	-	150	-	-	150	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	5	0	33	33	5	11	54	880	27	22	984	11

Major/Minor	Minor2		Minor1		Major1		Major2					
Conflicting Flow All	2045	2049	990	2052	2041	895	995	0	0	907	0	0
Stage 1	1034	1034	-	1002	1002	-	-	-	-	-	-	-
Stage 2	1011	1015	-	1050	1039	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	41	56	299	41	56	339	695	-	-	750	-	-
Stage 1	280	309	-	292	320	-	-	-	-	-	-	-
Stage 2	289	316	-	275	308	-	-	-	-	-	-	-
Platoon blocked, %								-	-	-	-	-
Mov Cap-1 Maneuver	33	50	299	34	50	339	695	-	-	750	-	-
Mov Cap-2 Maneuver	33	50	-	34	50	-	-	-	-	-	-	-
Stage 1	258	300	-	269	295	-	-	-	-	-	-	-
Stage 2	253	291	-	238	299	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	40.4	\$ 315.8	0.6	0.2
HCM LOS	E	F		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1WBLn1	SBL	SBT	SBR
Capacity (veh/h)	695	-	-	139 44	750	-	-
HCM Lane V/C Ratio	0.078	-	-	0.274 1.112	0.029	-	-
HCM Control Delay (s)	10.6	-	-	40.4\$ 315.8	9.9	-	-
HCM Lane LOS	B	-	-	E F	A	-	-
HCM 95th %tile Q(veh)	0.3	-	-	1 4.6	0.1	-	-

Notes
 -: Volume exceeds capacity \$: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

Intersection			
Intersection Delay, s/veh	13.1		
Intersection LOS	B		
Approach	EB	NB	SB
Entry Lanes	1	1	1
Conflicting Circle Lanes	1	1	1
Adj Approach Flow, veh/h	304	870	972
Demand Flow Rate, veh/h	310	888	991
Vehicles Circulating, veh/h	820	155	34
Vehicles Exiting, veh/h	205	975	1009
Ped Vol Crossing Leg, #/h	1	0	0
Ped Cap Adj	1.000	1.000	1.000
Approach Delay, s/veh	13.4	13.7	12.4
Approach LOS	B	B	B
Lane	Left	Left	Left
Designated Moves	LR	LT	TR
Assumed Moves	LR	LT	TR
RT Channelized			
Lane Util	1.000	1.000	1.000
Follow-Up Headway, s	2.500	2.500	2.500
Critical Headway, s	4.800	4.800	4.800
Entry Flow, veh/h	310	888	991
Cap Entry Lane, veh/h	641	1236	1393
Entry HV Adj Factor	0.981	0.980	0.981
Flow Entry, veh/h	304	870	972
Cap Entry, veh/h	629	1211	1366
V/C Ratio	0.483	0.719	0.712
Control Delay, s/veh	13.4	13.7	12.4
LOS	B	B	B
95th %tile Queue, veh	3	7	7

Intersection						
Int Delay, s/veh	4.7					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	0	170	245	795	930	15
Future Vol, veh/h	0	170	245	795	930	15
Conflicting Peds, #/hr	8	0	8	0	0	8
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	0	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	185	266	864	1011	16

Major/Minor	Minor2	Major1	Major2			
Conflicting Flow All	2431	1027	1035	0	-	0
Stage 1	1027	-	-	-	-	-
Stage 2	1404	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	35	285	672	-	-	-
Stage 1	345	-	-	-	-	-
Stage 2	227	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	21	283	667	-	-	-
Mov Cap-2 Maneuver	21	-	-	-	-	-
Stage 1	206	-	-	-	-	-
Stage 2	225	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	38.8	3.3	0
HCM LOS	E		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	667	-	283	-	-
HCM Lane V/C Ratio	0.399	-	0.653	-	-
HCM Control Delay (s)	13.9	-	38.8	-	-
HCM Lane LOS	B	-	E	-	-
HCM 95th %tile Q(veh)	1.9	-	4.2	-	-

Intersection						
Int Delay, s/veh	4.7					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	T			T		T
Traffic Vol, veh/h	5	95	100	1065	1110	15
Future Vol, veh/h	5	95	100	1065	1110	15
Conflicting Peds, #/hr	0	0	8	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	5	103	109	1158	1207	16

Major/Minor	Minor2	Major1	Major2			
Conflicting Flow All	2020	1223	1231	0	-	0
Stage 1	1223	-	-	-	-	-
Stage 2	797	-	-	-	-	-
Critical Hdwy	6.63	6.23	4.13	-	-	-
Critical Hdwy Stg 1	5.43	-	-	-	-	-
Critical Hdwy Stg 2	5.83	-	-	-	-	-
Follow-up Hdwy	3.519	3.319	2.219	-	-	-
Pot Cap-1 Maneuver	57	218	564	-	-	-
Stage 1	277	-	-	-	-	-
Stage 2	405	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	26	216	560	-	-	-
Mov Cap-2 Maneuver	26	-	-	-	-	-
Stage 1	125	-	-	-	-	-
Stage 2	402	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	67	3.9	0
HCM LOS	F		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	560	-	158	-	-
HCM Lane V/C Ratio	0.194	-	0.688	-	-
HCM Control Delay (s)	13	3	67	-	-
HCM Lane LOS	B	A	F	-	-
HCM 95th %tile Q(veh)	0.7	-	4	-	-

HCM Unsignalized Intersection Capacity Analysis
6: Kuhio Hwy & Cane Haul Rd

Kealia Mauka Homesites
01/24/2018



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations				↕↕	↔	
Traffic Volume (veh/h)	0	0	15	1170	850	360
Future Volume (Veh/h)	0	0	15	1170	850	360
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)	0	0	16	1272	924	391
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	1788	1120	1315			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1788	1120	1315			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	100	100	97			
cM capacity (veh/h)	70	201	522			
Direction, Lane #	NB 1	NB 2	SB 1			
Volume Total	440	848	1315			
Volume Left	16	0	0			
Volume Right	0	0	391			
cSH	522	1700	1700			
Volume to Capacity	0.03	0.50	0.77			
Queue Length 95th (ft)	2	0	0			
Control Delay (s)	0.9	0.0	0.0			
Lane LOS	A					
Approach Delay (s)	0.3		0.0			
Approach LOS						
Intersection Summary						
Average Delay			0.2			
Intersection Capacity Utilization			70.0%	ICU Level of Service		C
Analysis Period (min)			15			

Intersection						
Int Delay, s/veh	8.7					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	190	10	20	995	695	175
Future Vol, veh/h	190	10	20	995	695	175
Conflicting Peds, #/hr	0	0	8	0	0	8
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	150	-	-	-
Veh in Median Storage, #	2	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	207	11	22	1082	755	190

Major/Minor	Minor2	Major1	Major2			
Conflicting Flow All	1984	858	953	0	-	0
Stage 1	858	-	-	-	-	-
Stage 2	1126	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	~ 67	357	721	-	-	-
Stage 1	415	-	-	-	-	-
Stage 2	310	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	~ 64	354	716	-	-	-
Mov Cap-2 Maneuver	227	-	-	-	-	-
Stage 1	399	-	-	-	-	-
Stage 2	308	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	89.6	0.2	0
HCM LOS	F		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	716	-	231	-	-
HCM Lane V/C Ratio	0.03	-	0.941	-	-
HCM Control Delay (s)	10.2	-	89.6	-	-
HCM Lane LOS	B	-	F	-	-
HCM 95th %tile Q(veh)	0.1	-	8.2	-	-

Notes
 -: Volume exceeds capacity \$: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

Intersection												
Int Delay, s/veh	11.4											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	85	5	25	5	5	110	20	825	15	40	660	15
Future Vol, veh/h	85	5	25	5	5	110	20	825	15	40	660	15
Conflicting Peds, #/hr	0	0	34	34	0	0	30	0	35	35	0	30
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None									
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	2	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	92	5	27	5	5	120	22	897	16	43	717	16

Major/Minor	Minor2		Minor1		Major1		Major2					
Conflicting Flow All	1853	1833	789	1845	1833	940	763	0	0	948	0	0
Stage 1	841	841	-	984	984	-	-	-	-	-	-	-
Stage 2	1012	992	-	861	849	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	~ 57	76	391	57	76	320	850	-	-	724	-	-
Stage 1	359	380	-	299	327	-	-	-	-	-	-	-
Stage 2	288	324	-	350	377	-	-	-	-	-	-	-
Platoon blocked, %								-	-	-	-	-
Mov Cap-1 Maneuver	~ 28	60	368	43	60	309	826	-	-	700	-	-
Mov Cap-2 Maneuver	109	198	-	43	60	-	-	-	-	-	-	-
Stage 1	330	331	-	273	299	-	-	-	-	-	-	-
Stage 2	164	296	-	276	328	-	-	-	-	-	-	-

Approach	EB		WB		NB		SB	
HCM Control Delay, s	128.8		44.2		0.2		0.6	
HCM LOS	F		E					

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1WBLn1	SBL	SBT	SBR
Capacity (veh/h)	826	-	-	132	216	700	-
HCM Lane V/C Ratio	0.026	-	-	0.947	0.604	0.062	-
HCM Control Delay (s)	9.5	0	-	128.8	44.2	10.5	0
HCM Lane LOS	A	A	-	F	E	B	A
HCM 95th %tile Q(veh)	0.1	-	-	6.4	3.5	0.2	-

Notes
 -: Volume exceeds capacity \$: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

HCM Signalized Intersection Capacity Analysis

9: Kuhio Hwy & Kukui St

Kealia Mauka Homesites

01/24/2018



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	145	65	35	730	640	55
Future Volume (vph)	145	65	35	730	640	55
Ideal Flow (vphp)	1900	1900	1900	1000	1200	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	
Frpb, ped/bikes	1.00	0.82	1.00	1.00	0.99	
Flpb, ped/bikes	0.88	1.00	0.99	1.00	1.00	
Frt	1.00	0.85	1.00	1.00	0.99	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1552	1291	1757	850	1150	
Flt Permitted	0.95	1.00	0.31	1.00	1.00	
Satd. Flow (perm)	1552	1291	568	980	1150	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	158	71	38	793	696	60
RTOR Reduction (vph)	0	63	0	0	1	0
Lane Group Flow (vph)	158	8	38	793	755	0
Confl. Peds. (#/hr)	30	41	46			46
Turn Type	Perm	Perm	pm+pt	NA	NA	
Protected Phases			5	2	6	
Permitted Phases	4	4	2			
Actuated Green, G (s)	21.0	21.0	151.0	151.0	142.0	
Effective Green, g (s)	21.0	21.0	151.0	151.0	142.0	
Actuated g/C Ratio	0.12	0.12	0.84	0.84	0.79	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	181	150	509	713	907	
v/s Ratio Prot			0.00	c0.93	0.66	
v/s Ratio Perm	c0.10	0.01	0.06			
v/c Ratio	0.87	0.06	0.07	1.11	0.83	
Uniform Delay, d1	78.2	70.7	4.6	14.5	11.7	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	33.9	0.2	0.1	68.8	8.8	
Delay (s)	112.1	70.8	4.7	83.3	20.5	
Level of Service	F	E	A	F	C	
Approach Delay (s)	99.3			79.7	20.5	
Approach LOS	F			E	C	

Intersection Summary

HCM 2000 Control Delay	57.5	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.11		
Actuated Cycle Length (s)	180.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	95.4%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Intersection				
Intersection Delay, s/veh	10.9			
Intersection LOS	B			
Approach	EB	WB	NB	SB
Entry Lanes	1	1	1	1
Conflicting Circle Lanes	1	1	1	1
Adj Approach Flow, veh/h	451	511	266	479
Demand Flow Rate, veh/h	460	522	272	489
Vehicles Circulating, veh/h	412	78	500	600
Vehicles Exiting, veh/h	677	694	372	0
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	10.7	6.9	8.2	16.9
Approach LOS	B	A	A	C
Lane	Left	Left	Left	Left
Designated Moves	TR	LT	LR	LTR
Assumed Moves	TR	LT	LR	LTR
RT Channelized				
Lane Util	1.000	1.000	1.000	1.000
Follow-Up Headway, s	2.609	2.609	2.609	2.609
Critical Headway, s	4.976	4.976	4.976	4.976
Entry Flow, veh/h	460	522	272	489
Cap Entry Lane, veh/h	906	1274	829	748
Entry HV Adj Factor	0.980	0.980	0.978	0.980
Flow Entry, veh/h	451	511	266	479
Cap Entry, veh/h	888	1248	810	733
V/C Ratio	0.507	0.410	0.328	0.653
Control Delay, s/veh	10.7	6.9	8.2	16.9
LOS	B	A	A	C
95th %tile Queue, veh	3	2	1	5



APPENDIX C

LEVEL OF SERVICE CALCULATIONS

- Base Year 2027 with Mitigation (With Bypass) AM Peak
-
-

Intersection						
Int Delay, s/veh	4.2					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	20	5	5	15	5	10
Future Vol, veh/h	20	5	5	15	5	10
Conflicting Peds, #/hr	1	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	22	5	5	16	5	11

Major/Minor	Minor1	Major1	Major2			
Conflicting Flow All	35	13	0	0	21	0
Stage 1	13	-	-	-	-	-
Stage 2	22	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	978	1067	-	-	1595	-
Stage 1	1010	-	-	-	-	-
Stage 2	1001	-	-	-	-	-
Platoon blocked, %			-	-	-	-
Mov Cap-1 Maneuver	974	1067	-	-	1595	-
Mov Cap-2 Maneuver	974	-	-	-	-	-
Stage 1	1007	-	-	-	-	-
Stage 2	1000	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	8.7	0	2.4
HCM LOS	A		

Minor Lane/Major Mvmt	NBT	NBRWBLn1	SBL	SBT
Capacity (veh/h)	-	-	991	1595
HCM Lane V/C Ratio	-	-	0.027	0.003
HCM Control Delay (s)	-	-	8.7	7.3
HCM Lane LOS	-	-	A	A
HCM 95th %tile Q(veh)	-	-	0.1	0

Intersection												
Int Delay, s/veh	2.8											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕		↕	↕		↕	↕	
Traffic Vol, veh/h	10	0	25	20	5	10	20	745	30	10	805	5
Future Vol, veh/h	10	0	25	20	5	10	20	745	30	10	805	5
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None									
Storage Length	-	-	-	-	-	-	150	-	-	150	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	11	0	27	22	5	11	22	810	33	11	875	5

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1779	1787	878	1784	1773	827	880	0	0	843	0	0
Stage 1	900	900	-	871	871	-	-	-	-	-	-	-
Stage 2	879	887	-	913	902	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	64	81	347	63	83	371	768	-	-	793	-	-
Stage 1	333	357	-	346	368	-	-	-	-	-	-	-
Stage 2	342	362	-	328	356	-	-	-	-	-	-	-
Platoon blocked, %								-	-	-	-	-
Mov Cap-1 Maneuver	57	78	347	56	79	371	768	-	-	793	-	-
Mov Cap-2 Maneuver	57	78	-	56	79	-	-	-	-	-	-	-
Stage 1	323	352	-	336	357	-	-	-	-	-	-	-
Stage 2	318	352	-	298	351	-	-	-	-	-	-	-

Approach	EB			WB			NB			SB		
HCM Control Delay, s	39.7			88.9			0.2			0.1		
HCM LOS	E			F								

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1WBLn1	SBL	SBT	SBR
Capacity (veh/h)	768	-	-	141	78	793	-
HCM Lane V/C Ratio	0.028	-	-	0.27	0.488	0.014	-
HCM Control Delay (s)	9.8	-	-	39.7	88.9	9.6	-
HCM Lane LOS	A	-	-	E	F	A	-
HCM 95th %tile Q(veh)	0.1	-	-	1	2	0	-

Intersection			
Intersection Delay, s/veh	14.4		
Intersection LOS	B		
Approach	EB	NB	SB
Entry Lanes	1	1	1
Conflicting Circle Lanes	1	1	1
Adj Approach Flow, veh/h	462	669	907
Demand Flow Rate, veh/h	471	682	926
Vehicles Circulating, veh/h	743	310	111
Vehicles Exiting, veh/h	294	904	881
Ped Vol Crossing Leg, #/h	0	0	0
Ped Cap Adj	1.000	1.000	1.000
Approach Delay, s/veh	19.2	12.7	13.3
Approach LOS	C	B	B
Lane	Left	Left	Left
Designated Moves	LR	LT	TR
Assumed Moves	LR	LT	TR
RT Channelized			
Lane Util	1.000	1.000	1.000
Follow-Up Headway, s	2.500	2.500	2.500
Critical Headway, s	4.800	4.800	4.800
Entry Flow, veh/h	471	682	926
Cap Entry Lane, veh/h	692	1061	1291
Entry HV Adj Factor	0.981	0.981	0.980
Flow Entry, veh/h	462	669	907
Cap Entry, veh/h	679	1040	1265
V/C Ratio	0.681	0.643	0.717
Control Delay, s/veh	19.2	12.7	13.3
LOS	C	B	B
95th %tile Queue, veh	5	5	7

Intersection						
Int Delay, s/veh	8.6					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	5	220	280	550	760	30
Future Vol, veh/h	5	220	280	550	760	30
Conflicting Peds, #/hr	9	0	8	0	0	8
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	100	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	5	239	304	598	826	33

Major/Minor	Minor2	Major1	Major2			
Conflicting Flow All	2066	851	867	0	-	0
Stage 1	851	-	-	-	-	-
Stage 2	1215	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	60	360	777	-	-	-
Stage 1	419	-	-	-	-	-
Stage 2	281	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	36	357	771	-	-	-
Mov Cap-2 Maneuver	36	-	-	-	-	-
Stage 1	252	-	-	-	-	-
Stage 2	279	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	54.8	4.3	0
HCM LOS	F		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	771	-	298	-	-
HCM Lane V/C Ratio	0.395	-	0.821	-	-
HCM Control Delay (s)	12.7	-	54.8	-	-
HCM Lane LOS	B	-	F	-	-
HCM 95th %tile Q(veh)	1.9	-	6.8	-	-

Intersection						
Int Delay, s/veh	17.4					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↕	↕		↕	
Traffic Vol, veh/h	125	75	370	35	110	280
Future Vol, veh/h	125	75	370	35	110	280
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	136	82	402	38	120	304

Major/Minor	Major1	Major2	Minor2		
Conflicting Flow All	440	0	-	0	775 421
Stage 1	-	-	-	-	421 -
Stage 2	-	-	-	-	354 -
Critical Hdwy	4.12	-	-	-	6.42 6.22
Critical Hdwy Stg 1	-	-	-	-	5.42 -
Critical Hdwy Stg 2	-	-	-	-	5.42 -
Follow-up Hdwy	2.218	-	-	-	3.518 3.318
Pot Cap-1 Maneuver	1120	-	-	-	366 632
Stage 1	-	-	-	-	662 -
Stage 2	-	-	-	-	710 -
Platoon blocked, %		-	-	-	
Mov Cap-1 Maneuver	1120	-	-	-	320 632
Mov Cap-2 Maneuver	-	-	-	-	320 -
Stage 1	-	-	-	-	578 -
Stage 2	-	-	-	-	710 -

Approach	EB	WB	SB
HCM Control Delay, s	5.4	0	41.7
HCM LOS			E

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1120	-	-	-	496
HCM Lane V/C Ratio	0.121	-	-	-	0.855
HCM Control Delay (s)	8.7	0	-	-	41.7
HCM Lane LOS	A	A	-	-	E
HCM 95th %tile Q(veh)	0.4	-	-	-	8.9

Intersection

Int Delay, s/veh 5.2

Movement EBL EBR NBL NBT SBT SBR

Lane Configurations						
Traffic Vol, veh/h	80	105	45	870	730	350
Future Vol, veh/h	80	105	45	870	730	350
Conflicting Peds, #/hr	9	0	4	0	0	4
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	2	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	87	114	49	946	793	380

Major/Minor Minor2 Major1 Major2

Conflicting Flow All	2040	987	1177	0	-	0
Stage 1	987	-	-	-	-	-
Stage 2	1053	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	~ 62	300	593	-	-	-
Stage 1	361	-	-	-	-	-
Stage 2	336	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	~ 56	299	591	-	-	-
Mov Cap-2 Maneuver	211	-	-	-	-	-
Stage 1	330	-	-	-	-	-
Stage 2	335	-	-	-	-	-

Approach EB NB SB

HCM Control Delay, s	58	0.6	0
HCM LOS	F		

Minor Lane/Major Mvmt NBL NBT EBLn1 SBT SBR

Capacity (veh/h)	591	-	253	-	-
HCM Lane V/C Ratio	0.083	-	0.795	-	-
HCM Control Delay (s)	11.6	-	58	-	-
HCM Lane LOS	B	-	F	-	-
HCM 95th %tile Q(veh)	0.3	-	6	-	-

Notes

~: Volume exceeds capacity \$: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

Intersection						
Int Delay, s/veh	3.6					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	W		W	↑	↑	
Traffic Vol, veh/h	165	10	5	780	715	80
Future Vol, veh/h	165	10	5	780	715	80
Conflicting Peds, #/hr	0	0	5	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	150	-	-	-
Veh in Median Storage, #	2	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	179	11	5	848	777	87

Major/Minor	Minor2	Major1	Major2			
Conflicting Flow All	1684	826	869	0	-	0
Stage 1	826	-	-	-	-	-
Stage 2	858	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	~ 104	372	775	-	-	-
Stage 1	430	-	-	-	-	-
Stage 2	415	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	~ 102	370	771	-	-	-
Mov Cap-2 Maneuver	296	-	-	-	-	-
Stage 1	425	-	-	-	-	-
Stage 2	413	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	35.9	0.1	0
HCM LOS	E		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	771	-	299	-	-
HCM Lane V/C Ratio	0.007	-	0.636	-	-
HCM Control Delay (s)	9.7	-	35.9	-	-
HCM Lane LOS	A	-	E	-	-
HCM 95th %tile Q(veh)	0	-	4	-	-

Notes
 -: Volume exceeds capacity \$: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

Intersection												
Int Delay, s/veh	2.4											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	5	5	10	5	5	55	10	720	5	70	650	5
Future Vol, veh/h	5	5	10	5	5	55	10	720	5	70	650	5
Conflicting Peds, #/hr	0	0	13	13	0	0	12	0	14	14	0	12
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None									
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	5	5	11	5	5	60	11	783	5	76	707	5

Major/Minor	Minor2		Minor1		Major1		Major2					
Conflicting Flow All	1714	1698	735	1705	1698	800	724	0	0	802	0	0
Stage 1	874	874	-	822	822	-	-	-	-	-	-	-
Stage 2	840	824	-	883	876	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	71	92	420	72	92	385	879	-	-	822	-	-
Stage 1	344	367	-	368	388	-	-	-	-	-	-	-
Stage 2	360	387	-	340	367	-	-	-	-	-	-	-
Platoon blocked, %								-	-	-	-	-
Mov Cap-1 Maneuver	48	74	410	56	74	380	869	-	-	811	-	-
Mov Cap-2 Maneuver	48	74	-	56	74	-	-	-	-	-	-	-
Stage 1	332	307	-	355	374	-	-	-	-	-	-	-
Stage 2	292	373	-	271	307	-	-	-	-	-	-	-

Approach	EB		WB		NB		SB	
HCM Control Delay, s	49.6		29.6		0.1		1	
HCM LOS	E		D					

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1WBLn1	SBL	SBT	SBR
Capacity (veh/h)	869	-	-	102	216	811	-
HCM Lane V/C Ratio	0.013	-	-	0.213	0.327	0.094	-
HCM Control Delay (s)	9.2	0	-	49.6	29.6	9.9	0
HCM Lane LOS	A	A	-	E	D	A	A
HCM 95th %tile Q(veh)	0	-	-	0.8	1.4	0.3	-

HCM Signalized Intersection Capacity Analysis

9: Kuhio Hwy & Kukui St

Kealia Mauka Homesites

01/24/2018



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕	↗			↗	↖	↖			↕	
Traffic Volume (vph)	40	5	60	0	0	15	25	690	20	0	625	35
Future Volume (vph)	40	5	60	0	0	15	25	690	20	0	625	35
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1200	1900	1900	1200	1900
Total Lost time (s)		4.0	4.0			4.0	4.0	4.0			4.0	
Lane Util. Factor		1.00	1.00			1.00	1.00	1.00			1.00	
Frbp, ped/bikes		1.00	0.95			0.94	1.00	1.00			1.00	
Flpb, ped/bikes		0.97	1.00			1.00	1.00	1.00			1.00	
Frt		1.00	0.85			0.86	1.00	1.00			0.99	
Flt Protected		0.96	1.00			1.00	0.95	1.00			1.00	
Satd. Flow (prot)		1737	1500			1509	1769	1169			1166	
Flt Permitted		0.96	1.00			1.00	0.35	1.00			1.00	
Satd. Flow (perm)		1737	1500			1509	649	1169			1166	
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)	43	5	65	0	0	16	27	750	22	0	679	38
RTOR Reduction (vph)	0	0	61	0	0	15	0	0	0	0	1	0
Lane Group Flow (vph)	0	48	4	0	0	1	27	772	0	0	716	0
Confl. Peds. (#/hr)	6		7			6	2		13	13		2
Turn Type	Perm	NA	Perm			Perm	pm+pt	NA			NA	
Protected Phases		4					5	2			6	
Permitted Phases	4		4			8	2		6			
Actuated Green, G (s)		14.3	14.3			14.3	187.7	187.7			178.9	
Effective Green, g (s)		14.3	14.3			14.3	187.7	187.7			178.9	
Actuated g/C Ratio		0.07	0.07			0.07	0.89	0.89			0.85	
Clearance Time (s)		4.0	4.0			4.0	4.0	4.0			4.0	
Vehicle Extension (s)		3.0	3.0			3.0	3.0	3.0			3.0	
Lane Grp Cap (vph)		118	102			102	605	1044			993	
v/s Ratio Prot							0.00	c0.66			0.61	
v/s Ratio Perm		0.03	0.00			0.00	0.04					
v/c Ratio		0.41	0.04			0.01	0.04	0.74			0.72	
Uniform Delay, d1		93.8	91.5			91.3	2.3	3.5			6.0	
Progression Factor		1.00	1.00			1.00	1.00	1.00			1.00	
Incremental Delay, d2		2.3	0.2			0.0	0.0	4.7			4.5	
Delay (s)		96.1	91.6			91.3	2.3	8.2			10.5	
Level of Service		F	F			F	A	A			B	
Approach Delay (s)		93.5		91.3				8.0			10.5	
Approach LOS		F		F				A			B	

Intersection Summary

HCM 2000 Control Delay	15.8	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.73		
Actuated Cycle Length (s)	210.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	80.7%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Intersection				
Intersection Delay, s/veh	24.5			
Intersection LOS	C			
Approach	EB	WB	NB	SB
Entry Lanes	1	1	1	1
Conflicting Circle Lanes	1	1	1	1
Adj Approach Flow, veh/h	685	255	44	766
Demand Flow Rate, veh/h	698	260	44	781
Vehicles Circulating, veh/h	593	238	670	277
Vehicles Exiting, veh/h	465	476	621	221
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	40.9	5.7	5.9	17.1
Approach LOS	E	A	A	C
Lane	Left	Left	Left	Left
Designated Moves	LTR	LTR	LTR	LTR
Assumed Moves	LTR	LTR	LTR	LTR
RT Channelized				
Lane Util	1.000	1.000	1.000	1.000
Follow-Up Headway, s	2.609	2.609	2.609	2.609
Critical Headway, s	4.976	4.976	4.976	4.976
Entry Flow, veh/h	698	260	44	781
Cap Entry Lane, veh/h	754	1082	697	1040
Entry HV Adj Factor	0.981	0.980	0.995	0.981
Flow Entry, veh/h	685	255	44	766
Cap Entry, veh/h	739	1061	693	1020
V/C Ratio	0.926	0.240	0.063	0.751
Control Delay, s/veh	40.9	5.7	5.9	17.1
LOS	E	A	A	C
95th %tile Queue, veh	13	1	0	7



APPENDIX C

LEVEL OF SERVICE CALCULATIONS

- Base Year 2027 with Mitigation (With Bypass) PM Peak
-
-

Intersection						
Int Delay, s/veh	1.7					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	W		T			T
Traffic Vol, veh/h	10	0	30	20	5	10
Future Vol, veh/h	10	0	30	20	5	10
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	11	0	33	22	5	11

Major/Minor	Minor1	Major1	Major2			
Conflicting Flow All	65	44	0	0	55	0
Stage 1	44	-	-	-	-	-
Stage 2	21	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	941	1026	-	-	1550	-
Stage 1	978	-	-	-	-	-
Stage 2	1002	-	-	-	-	-
Platoon blocked, %			-	-	-	-
Mov Cap-1 Maneuver	938	1026	-	-	1550	-
Mov Cap-2 Maneuver	938	-	-	-	-	-
Stage 1	975	-	-	-	-	-
Stage 2	1002	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	8.9	0	2.4
HCM LOS	A		

Minor Lane/Major Mvmt	NBT	NBRWBLn1	SBL	SBT
Capacity (veh/h)	-	-	938	1550
HCM Lane V/C Ratio	-	-	0.012	0.004
HCM Control Delay (s)	-	-	8.9	7.3
HCM Lane LOS	-	-	A	A
HCM 95th %tile Q(veh)	-	-	0	0

Intersection												
Int Delay, s/veh	8.6											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕		↕	↕		↕	↕	
Traffic Vol, veh/h	5	0	30	30	5	10	50	810	25	20	905	10
Future Vol, veh/h	5	0	30	30	5	10	50	810	25	20	905	10
Conflicting Peds, #/hr	1	0	0	0	0	1	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None									
Storage Length	-	-	-	-	-	-	150	-	-	150	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	5	0	33	33	5	11	54	880	27	22	984	11

Major/Minor	Minor2		Minor1		Major1		Major2					
Conflicting Flow All	2045	2049	990	2052	2041	895	995	0	0	907	0	0
Stage 1	1034	1034	-	1002	1002	-	-	-	-	-	-	-
Stage 2	1011	1015	-	1050	1039	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	41	56	299	41	56	339	695	-	-	750	-	-
Stage 1	280	309	-	292	320	-	-	-	-	-	-	-
Stage 2	289	316	-	275	308	-	-	-	-	-	-	-
Platoon blocked, %								-	-	-	-	-
Mov Cap-1 Maneuver	33	50	299	34	50	339	695	-	-	750	-	-
Mov Cap-2 Maneuver	33	50	-	34	50	-	-	-	-	-	-	-
Stage 1	258	300	-	269	295	-	-	-	-	-	-	-
Stage 2	253	291	-	238	299	-	-	-	-	-	-	-

Approach	EB		WB		NB		SB	
HCM Control Delay, s	40.4		\$ 315.8		0.6		0.2	
HCM LOS	E		F					

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	695	-	-	139	44	750	-	-
HCM Lane V/C Ratio	0.078	-	-	0.274	1.112	0.029	-	-
HCM Control Delay (s)	10.6	-	-	40.4	\$ 315.8	9.9	-	-
HCM Lane LOS	B	-	-	E	F	A	-	-
HCM 95th %tile Q(veh)	0.3	-	-	1	4.6	0.1	-	-

Notes
 -: Volume exceeds capacity \$: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

Intersection			
Intersection Delay, s/veh	12.9		
Intersection LOS	B		
Approach	EB	NB	SB
Entry Lanes	1	1	1
Conflicting Circle Lanes	1	1	1
Adj Approach Flow, veh/h	272	832	972
Demand Flow Rate, veh/h	278	849	991
Vehicles Circulating, veh/h	820	189	34
Vehicles Exiting, veh/h	205	909	1004
Ped Vol Crossing Leg, #/h	1	0	0
Ped Cap Adj	1.000	1.000	1.000
Approach Delay, s/veh	12.2	13.8	12.4
Approach LOS	B	B	B
Lane	Left	Left	Left
Designated Moves	LR	LT	TR
Assumed Moves	LR	LT	TR
RT Channelized			
Lane Util	1.000	1.000	1.000
Follow-Up Headway, s	2.500	2.500	2.500
Critical Headway, s	4.800	4.800	4.800
Entry Flow, veh/h	278	849	991
Cap Entry Lane, veh/h	641	1195	1393
Entry HV Adj Factor	0.978	0.980	0.981
Flow Entry, veh/h	272	832	972
Cap Entry, veh/h	628	1171	1366
V/C Ratio	0.433	0.710	0.712
Control Delay, s/veh	12.2	13.8	12.4
LOS	B	B	B
95th %tile Queue, veh	2	6	7

Intersection						
Int Delay, s/veh	3.3					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	0	145	210	760	865	15
Future Vol, veh/h	0	145	210	760	865	15
Conflicting Peds, #/hr	8	0	8	0	0	8
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	100	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	158	228	826	940	16

Major/Minor	Minor2	Major1	Major2			
Conflicting Flow All	2246	956	964	0	-	0
Stage 1	956	-	-	-	-	-
Stage 2	1290	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	46	313	714	-	-	-
Stage 1	373	-	-	-	-	-
Stage 2	258	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	31	311	709	-	-	-
Mov Cap-2 Maneuver	31	-	-	-	-	-
Stage 1	251	-	-	-	-	-
Stage 2	256	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	27.9	2.7	0
HCM LOS	D		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	709	-	311	-	-
HCM Lane V/C Ratio	0.322	-	0.507	-	-
HCM Control Delay (s)	12.5	-	27.9	-	-
HCM Lane LOS	B	-	D	-	-
HCM 95th %tile Q(veh)	1.4	-	2.7	-	-

Intersection						
Int Delay, s/veh	5.4					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↶	↷		↶	↷
Traffic Vol, veh/h	135	80	335	50	50	135
Future Vol, veh/h	135	80	335	50	50	135
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	147	87	364	54	54	147

Major/Minor	Major1	Major2	Minor2		
Conflicting Flow All	418	0	-	0	772
Stage 1	-	-	-	-	391
Stage 2	-	-	-	-	381
Critical Hdwy	4.12	-	-	-	6.42
Critical Hdwy Stg 1	-	-	-	-	5.42
Critical Hdwy Stg 2	-	-	-	-	5.42
Follow-up Hdwy	2.218	-	-	-	3.518
Pot Cap-1 Maneuver	1141	-	-	-	368
Stage 1	-	-	-	-	683
Stage 2	-	-	-	-	691
Platoon blocked, %		-	-	-	
Mov Cap-1 Maneuver	1141	-	-	-	318
Mov Cap-2 Maneuver	-	-	-	-	318
Stage 1	-	-	-	-	591
Stage 2	-	-	-	-	691

Approach	EB	WB	SB
HCM Control Delay, s	5.4	0	16.6
HCM LOS			C

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1141	-	-	-	510
HCM Lane V/C Ratio	0.129	-	-	-	0.394
HCM Control Delay (s)	8.6	0	-	-	16.6
HCM Lane LOS	A	A	-	-	C
HCM 95th %tile Q(veh)	0.4	-	-	-	1.9

Intersection						
Int Delay, s/veh	2.8					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	80	50	50	925	725	320
Future Vol, veh/h	80	50	50	925	725	320
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	2	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	87	54	54	1005	788	348

Major/Minor	Minor2	Major1	Major2			
Conflicting Flow All	2075	962	1136	0	-	0
Stage 1	962	-	-	-	-	-
Stage 2	1113	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	~ 59	310	615	-	-	-
Stage 1	371	-	-	-	-	-
Stage 2	314	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	~ 54	310	615	-	-	-
Mov Cap-2 Maneuver	201	-	-	-	-	-
Stage 1	338	-	-	-	-	-
Stage 2	314	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	42.1	0.6	0
HCM LOS	E		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	615	-	232	-	-
HCM Lane V/C Ratio	0.088	-	0.609	-	-
HCM Control Delay (s)	11.4	-	42.1	-	-
HCM Lane LOS	B	-	E	-	-
HCM 95th %tile Q(veh)	0.3	-	3.6	-	-

Notes
 -: Volume exceeds capacity \$: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

Intersection						
Int Delay, s/veh	4.8					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	180	10	20	795	615	175
Future Vol, veh/h	180	10	20	795	615	175
Conflicting Peds, #/hr	0	0	8	0	0	8
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	150	-	-	-
Veh in Median Storage, #	2	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	196	11	22	864	668	190

Major/Minor	Minor2	Major1	Major2			
Conflicting Flow All	1679	771	866	0	-	0
Stage 1	771	-	-	-	-	-
Stage 2	908	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	~ 104	400	777	-	-	-
Stage 1	456	-	-	-	-	-
Stage 2	393	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	~ 99	397	771	-	-	-
Mov Cap-2 Maneuver	283	-	-	-	-	-
Stage 1	439	-	-	-	-	-
Stage 2	390	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	44.1	0.2	0
HCM LOS	E		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	771	-	287	-	-
HCM Lane V/C Ratio	0.028	-	0.72	-	-
HCM Control Delay (s)	9.8	-	44.1	-	-
HCM Lane LOS	A	-	E	-	-
HCM 95th %tile Q(veh)	0.1	-	5.1	-	-

Notes
 -: Volume exceeds capacity \$: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

Intersection												
Int Delay, s/veh	3.2											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	5	5	25	5	5	95	20	720	5	40	585	15
Future Vol, veh/h	5	5	25	5	5	95	20	720	5	40	585	15
Conflicting Peds, #/hr	0	0	34	34	0	0	30	0	35	35	0	30
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None									
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	5	5	27	5	5	103	22	783	5	43	636	16

Major/Minor	Minor2		Minor1		Major1		Major2					
Conflicting Flow All	1644	1627	708	1645	1633	821	682	0	0	823	0	0
Stage 1	760	760	-	865	865	-	-	-	-	-	-	-
Stage 2	884	867	-	780	768	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	80	102	435	79	101	374	911	-	-	807	-	-
Stage 1	398	414	-	348	371	-	-	-	-	-	-	-
Stage 2	340	370	-	388	411	-	-	-	-	-	-	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	48	84	409	59	83	362	885	-	-	780	-	-
Mov Cap-2 Maneuver	48	84	-	59	83	-	-	-	-	-	-	-
Stage 1	370	367	-	322	343	-	-	-	-	-	-	-
Stage 2	229	342	-	315	365	-	-	-	-	-	-	-

Approach	EB		WB		NB		SB	
HCM Control Delay, s	35.4		29.6		0.2		0.6	
HCM LOS	E		D					

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1WBLn1	SBL	SBT	SBR
Capacity (veh/h)	885	-	-	156	258	780	-
HCM Lane V/C Ratio	0.025	-	-	0.244	0.442	0.056	-
HCM Control Delay (s)	9.2	0	-	35.4	29.6	9.9	0
HCM Lane LOS	A	A	-	E	D	A	A
HCM 95th %tile Q(veh)	0.1	-	-	0.9	2.1	0.2	-

HCM Signalized Intersection Capacity Analysis

9: Kuhio Hwy & Kukui St

Kealia Mauka Homesites

01/24/2018



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕	↗			↗	↖	↖			↕	
Traffic Volume (vph)	35	15	60	0	0	25	35	695	10	5	560	55
Future Volume (vph)	35	15	60	0	0	25	35	695	10	5	560	55
Ideal Flow (vphp)	1900	1900	1900	1900	1900	1900	1900	1200	1900	1900	1200	1900
Total Lost time (s)		4.0	4.0			4.0	4.0	4.0			4.0	
Lane Util. Factor		1.00	1.00			1.00	1.00	1.00			1.00	
Frbp, ped/bikes		1.00	0.87			0.88	1.00	1.00			0.99	
Flpb, ped/bikes		0.94	1.00			1.00	0.99	1.00			1.00	
Frt		1.00	0.85			0.86	1.00	1.00			0.99	
Flt Protected		0.97	1.00			1.00	0.95	1.00			1.00	
Satd. Flow (prot)		1696	1378			1418	1753	1171			1150	
Flt Permitted		0.97	1.00			1.00	0.37	1.00			1.00	
Satd. Flow (perm)		1696	1378			1418	682	1171			1146	
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	16	65	0	0	27	38	755	11	5	609	60
RTOR Reduction (vph)	0	0	55	0	0	23	0	0	0	0	2	0
Lane Group Flow (vph)	0	54	10	0	0	4	38	766	0	0	672	0
Confl. Peds. (#/hr)	30		41	41		30	46		68	68		46
Turn Type	Perm	NA	Perm			Perm	pm+pt	NA		Perm	NA	
Protected Phases		4					5	2				6
Permitted Phases	4		4			8	2		6			
Actuated Green, G (s)		17.6	17.6			17.6	94.4	94.4			86.5	
Effective Green, g (s)		17.6	17.6			17.6	94.4	94.4			86.5	
Actuated g/C Ratio		0.15	0.15			0.15	0.79	0.79			0.72	
Clearance Time (s)		4.0	4.0			4.0	4.0	4.0			4.0	
Vehicle Extension (s)		3.0	3.0			3.0	3.0	3.0			3.0	
Lane Grp Cap (vph)		248	202			207	571	921			826	
v/s Ratio Prot							0.00	c0.65				
v/s Ratio Perm		0.03	0.01			0.00	0.05				0.59	
v/c Ratio		0.22	0.05			0.02	0.07	0.83			0.81	
Uniform Delay, d1		45.1	44.0			43.8	3.6	7.9			11.3	
Progression Factor		1.00	1.00			1.00	1.00	1.00			1.00	
Incremental Delay, d2		0.4	0.1			0.0	0.0	8.6			8.6	
Delay (s)		45.6	44.1			43.9	3.7	16.5			19.9	
Level of Service		D	D			D	A	B			B	
Approach Delay (s)		44.8			43.9			15.9			19.9	
Approach LOS		D			D			B			B	

Intersection Summary

HCM 2000 Control Delay	20.2	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.76		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	87.9%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Intersection				
Intersection Delay, s/veh	15.5			
Intersection LOS	C			
Approach	EB	WB	NB	SB
Entry Lanes	1	1	1	1
Conflicting Circle Lanes	1	1	1	1
Adj Approach Flow, veh/h	461	516	277	586
Demand Flow Rate, veh/h	471	527	283	598
Vehicles Circulating, veh/h	488	311	532	600
Vehicles Exiting, veh/h	710	504	427	238
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	12.6	10.2	8.8	25.4
Approach LOS	B	B	A	D
Lane	Left	Left	Left	Left
Designated Moves	LTR	LTR	LTR	LTR
Assumed Moves	LTR	LTR	LTR	LTR
RT Channelized				
Lane Util	1.000	1.000	1.000	1.000
Follow-Up Headway, s	2.609	2.609	2.609	2.609
Critical Headway, s	4.976	4.976	4.976	4.976
Entry Flow, veh/h	471	527	283	598
Cap Entry Lane, veh/h	839	1005	802	748
Entry HV Adj Factor	0.980	0.980	0.980	0.980
Flow Entry, veh/h	461	516	277	586
Cap Entry, veh/h	822	985	786	733
V/C Ratio	0.561	0.524	0.353	0.799
Control Delay, s/veh	12.6	10.2	8.8	25.4
LOS	B	B	A	D
95th %tile Queue, veh	4	3	2	8



APPENDIX C

LEVEL OF SERVICE CALCULATIONS

- Future Year 2027 (Without Bypass) AM Peak
-
-

Intersection						
Int Delay, s/veh	1.2					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	20	5	50	15	5	140
Future Vol, veh/h	20	5	50	15	5	140
Conflicting Peds, #/hr	1	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	22	5	54	16	5	152

Major/Minor	Minor1	Major1	Major2			
Conflicting Flow All	225	62	0	0	70	0
Stage 1	62	-	-	-	-	-
Stage 2	163	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	763	1003	-	-	1531	-
Stage 1	961	-	-	-	-	-
Stage 2	866	-	-	-	-	-
Platoon blocked, %			-	-		
Mov Cap-1 Maneuver	759	1003	-	-	1531	-
Mov Cap-2 Maneuver	759	-	-	-	-	-
Stage 1	957	-	-	-	-	-
Stage 2	865	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	9.7	0	0.3
HCM LOS	A		

Minor Lane/Major Mvmt	NBT	NBRWBLn1	SBL	SBT
Capacity (veh/h)	-	-	798	1531
HCM Lane V/C Ratio	-	-	0.034	0.004
HCM Control Delay (s)	-	-	9.7	7.4
HCM Lane LOS	-	-	A	A
HCM 95th %tile Q(veh)	-	-	0.1	0

Intersection												
Int Delay, s/veh	31.8											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕		↕	↕		↕	↕	
Traffic Vol, veh/h	45	0	120	20	5	10	60	745	30	10	805	15
Future Vol, veh/h	45	0	120	20	5	10	60	745	30	10	805	15
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None									
Storage Length	-	-	-	-	-	-	150	-	-	150	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	49	0	130	22	5	11	65	810	33	11	875	16

Major/Minor	Minor2		Minor1		Major1			Major2				
Conflicting Flow All	1870	1878	883	1927	1870	827	891	0	0	843	0	0
Stage 1	905	905	-	957	957	-	-	-	-	-	-	-
Stage 2	965	973	-	970	913	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	55	71	345	50	72	371	761	-	-	793	-	-
Stage 1	331	355	-	310	336	-	-	-	-	-	-	-
Stage 2	306	330	-	304	352	-	-	-	-	-	-	-
Platoon blocked, %								-	-	-	-	-
Mov Cap-1 Maneuver	~ 46	64	345	29	65	371	761	-	-	793	-	-
Mov Cap-2 Maneuver	~ 46	64	-	29	65	-	-	-	-	-	-	-
Stage 1	303	350	-	284	307	-	-	-	-	-	-	-
Stage 2	267	302	-	186	347	-	-	-	-	-	-	-

Approach	EB		WB		NB		SB	
HCM Control Delay, s\$	304.7		237.4		0.7		0.1	
HCM LOS	F		F					

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	761	-	-	124	44	793	-	-
HCM Lane V/C Ratio	0.086	-	-	1.446	0.865	0.014	-	-
HCM Control Delay (s)	10.2	-	-	\$ 304.7	237.4	9.6	-	-
HCM Lane LOS	B	-	-	F	F	A	-	-
HCM 95th %tile Q(veh)	0.3	-	-	12.4	3.4	0	-	-

Notes
 -: Volume exceeds capacity \$: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

Intersection			
Intersection Delay, s/veh	18.9		
Intersection LOS	C		
Approach	EB	NB	SB
Entry Lanes	1	1	1
Conflicting Circle Lanes	1	1	1
Adj Approach Flow, veh/h	511	734	1005
Demand Flow Rate, veh/h	522	749	1025
Vehicles Circulating, veh/h	820	289	111
Vehicles Exiting, veh/h	316	1053	926
Ped Vol Crossing Leg, #/h	0	0	0
Ped Cap Adj	1.000	1.000	1.000
Approach Delay, s/veh	30.0	14.1	16.7
Approach LOS	D	B	C
Lane	Left	Left	Left
Designated Moves	LR	LT	TR
Assumed Moves	LR	LT	TR
RT Channelized			
Lane Util	1.000	1.000	1.000
Follow-Up Headway, s	2.500	2.500	2.500
Critical Headway, s	4.800	4.800	4.800
Entry Flow, veh/h	522	749	1025
Cap Entry Lane, veh/h	641	1083	1291
Entry HV Adj Factor	0.979	0.981	0.980
Flow Entry, veh/h	511	734	1005
Cap Entry, veh/h	628	1062	1265
V/C Ratio	0.814	0.692	0.794
Control Delay, s/veh	30.0	14.1	16.7
LOS	D	B	C
95th %tile Queue, veh	8	6	9

Intersection						
Int Delay, s/veh	27.5					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↔		↔	↑	↑	
Traffic Vol, veh/h	5	260	330	605	900	30
Future Vol, veh/h	5	260	330	605	900	30
Conflicting Peds, #/hr	9	0	8	0	0	8
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	0	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	5	283	359	658	978	33

Major/Minor	Minor2	Major1	Major2			
Conflicting Flow All	2388	1003	1019	0	-	0
Stage 1	1003	-	-	-	-	-
Stage 2	1385	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	37	294	681	-	-	-
Stage 1	355	-	-	-	-	-
Stage 2	232	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	17	292	676	-	-	-
Mov Cap-2 Maneuver	17	-	-	-	-	-
Stage 1	165	-	-	-	-	-
Stage 2	230	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	201.3	5.7	0
HCM LOS	F		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	676	-	224	-	-
HCM Lane V/C Ratio	0.531	-	1.286	-	-
HCM Control Delay (s)	16.2	-	201.3	-	-
HCM Lane LOS	C	-	F	-	-
HCM 95th %tile Q(veh)	3.1	-	15.1	-	-

Intersection

Int Delay, s/veh 47.3

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↔			↕	↕	
Traffic Vol, veh/h	10	270	70	975	1180	10
Future Vol, veh/h	10	270	70	975	1180	10
Conflicting Peds, #/hr	9	0	4	0	0	4
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	11	293	76	1060	1283	11

Major/Minor

	Minor2	Major1	Major2			
Conflicting Flow All	1984	1293	1298	0	-	0
Stage 1	1293	-	-	-	-	-
Stage 2	691	-	-	-	-	-
Critical Hdwy	6.63	6.23	4.13	-	-	-
Critical Hdwy Stg 1	5.43	-	-	-	-	-
Critical Hdwy Stg 2	5.83	-	-	-	-	-
Follow-up Hdwy	3.519	3.319	2.219	-	-	-
Pot Cap-1 Maneuver	60	~ 198	532	-	-	-
Stage 1	256	-	-	-	-	-
Stage 2	460	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	39	~ 197	530	-	-	-
Mov Cap-2 Maneuver	39	-	-	-	-	-
Stage 1	166	-	-	-	-	-
Stage 2	458	-	-	-	-	-

Approach

	EB	NB	SB
HCM Control Delay, s	\$ 415	2.7	0
HCM LOS	F		

Minor Lane/Major Mvmt

	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	530	-	172	-	-
HCM Lane V/C Ratio	0.144	-	1.769	-	-
HCM Control Delay (s)	12.9	2	\$ 415	-	-
HCM Lane LOS	B	A	F	-	-
HCM 95th %tile Q(veh)	0.5	-	21.8	-	-

Notes

~: Volume exceeds capacity \$: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

HCM Unsignalized Intersection Capacity Analysis
6: Kuhio Hwy & Cane Haul Rd

Kealia Mauka Homesites
01/24/2018



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations				↔↔	↔	
Traffic Volume (veh/h)	0	0	20	1110	1010	515
Future Volume (Veh/h)	0	0	20	1110	1010	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)	0	0	22	1207	1098	560
Pedestrians	4				9	
Lane Width (ft)	0.0				12.0	
Walking Speed (ft/s)	3.5				3.5	
Percent Blockage	0				1	
Right turn flare (veh)						
Median type				None	None	
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	2038	1382	1662			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	2038	1382	1662			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	100	100	94			
cM capacity (veh/h)	46	134	383			
Direction, Lane #	NB 1	NB 2	SB 1			
Volume Total	424	805	1658			
Volume Left	22	0	0			
Volume Right	0	0	560			
cSH	383	1700	1700			
Volume to Capacity	0.06	0.47	0.98			
Queue Length 95th (ft)	5	0	0			
Control Delay (s)	1.8	0.0	0.0			
Lane LOS	A					
Approach Delay (s)	0.6		0.0			
Approach LOS						
Intersection Summary						
Average Delay			0.3			
Intersection Capacity Utilization			88.0%	ICU Level of Service	E	
Analysis Period (min)			15			

Intersection						
Int Delay, s/veh	8.6					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	190	10	5	980	895	80
Future Vol, veh/h	190	10	5	980	895	80
Conflicting Peds, #/hr	0	0	5	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	150	-	-	-
Veh in Median Storage, #	2	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	207	11	5	1065	973	87

Major/Minor	Minor2	Major1	Major2			
Conflicting Flow All	2097	1022	1065	0	-	0
Stage 1	1022	-	-	-	-	-
Stage 2	1075	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	~ 57	287	654	-	-	-
Stage 1	347	-	-	-	-	-
Stage 2	328	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	~ 56	286	651	-	-	-
Mov Cap-2 Maneuver	227	-	-	-	-	-
Stage 1	342	-	-	-	-	-
Stage 2	326	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	92.1	0.1	0
HCM LOS	F		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	651	-	229	-	-
HCM Lane V/C Ratio	0.008	-	0.949	-	-
HCM Control Delay (s)	10.6	-	92.1	-	-
HCM Lane LOS	B	-	F	-	-
HCM 95th %tile Q(veh)	0	-	8.3	-	-

Notes
 -: Volume exceeds capacity \$: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

Intersection												
Int Delay, s/veh	10.3											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	105	5	10	5	5	65	10	815	15	70	825	5
Future Vol, veh/h	105	5	10	5	5	65	10	815	15	70	825	5
Conflicting Peds, #/hr	0	0	13	13	0	0	12	0	14	14	0	12
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None									
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	2	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	114	5	11	5	5	71	11	886	16	76	897	5

Major/Minor	Minor2		Minor1		Major1		Major2					
Conflicting Flow All	2018	2002	925	2003	1996	908	914	0	0	916	0	0
Stage 1	1064	1064	-	930	930	-	-	-	-	-	-	-
Stage 2	954	938	-	1073	1066	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	~ 43	60	326	44	60	334	746	-	-	745	-	-
Stage 1	270	300	-	321	346	-	-	-	-	-	-	-
Stage 2	311	343	-	267	299	-	-	-	-	-	-	-
Platoon blocked, %								-	-	-	-	-
Mov Cap-1 Maneuver	~ 25	45	318	33	45	330	737	-	-	735	-	-
Mov Cap-2 Maneuver	128	168	-	33	45	-	-	-	-	-	-	-
Stage 1	259	235	-	307	331	-	-	-	-	-	-	-
Stage 2	233	328	-	197	234	-	-	-	-	-	-	-

Approach	EB		WB		NB		SB	
HCM Control Delay, s	129.5		47.4		0.1		0.8	
HCM LOS	F		E					

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1WBLn1	SBL	SBT	SBR
Capacity (veh/h)	737	-	-	136	163	735	-
HCM Lane V/C Ratio	0.015	-	-	0.959	0.5	0.104	-
HCM Control Delay (s)	10	0	-	129.5	47.4	10.5	0
HCM Lane LOS	A	A	-	F	E	B	A
HCM 95th %tile Q(veh)	0	-	-	6.7	2.4	0.3	-

Notes
 -: Volume exceeds capacity \$: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

HCM Signalized Intersection Capacity Analysis

9: Kuhio Hwy & Kukui St

Kealia Mauka Homesites

01/24/2018



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	105	65	25	740	800	35
Future Volume (vph)	105	65	25	740	800	35
Ideal Flow (vphpl)	1900	1900	1900	1000	1200	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	
Frpb, ped/bikes	1.00	0.95	1.00	1.00	1.00	
Flpb, ped/bikes	0.98	1.00	1.00	1.00	1.00	
Frt	1.00	0.85	1.00	1.00	0.99	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1726	1507	1770	800	1169	
Flt Permitted	0.95	1.00	0.25	1.00	1.00	
Satd. Flow (perm)	1726	1507	472	980	1169	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	114	71	27	804	870	38
RTOR Reduction (vph)	0	64	0	0	1	0
Lane Group Flow (vph)	114	7	27	804	907	0
Confl. Peds. (#/hr)	6	7	2			2
Turn Type	Perm	Perm	pm+pt	NA	NA	
Protected Phases			5	2	6	
Permitted Phases	4	4	2			
Actuated Green, G (s)	16.9	16.9	155.1	155.1	146.3	
Effective Green, g (s)	16.9	16.9	155.1	155.1	146.3	
Actuated g/C Ratio	0.09	0.09	0.86	0.86	0.81	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	162	141	441	689	950	
v/s Ratio Prot			0.00	c1.00	0.78	
v/s Ratio Perm	c0.07	0.00	0.05			
v/c Ratio	0.70	0.05	0.06	1.17	0.96	
Uniform Delay, d1	79.1	74.2	5.2	12.5	14.1	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	13.0	0.1	0.1	90.3	20.2	
Delay (s)	92.1	74.4	5.2	102.8	34.3	
Level of Service	F	E	A	F	C	
Approach Delay (s)	85.3			99.6	34.3	
Approach LOS	F			F	C	

Intersection Summary

HCM 2000 Control Delay	67.4	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.15		
Actuated Cycle Length (s)	180.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	89.1%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Intersection				
Intersection Delay, s/veh	17.6			
Intersection LOS	C			
Approach	EB	WB	NB	SB
Entry Lanes	1	1	1	1
Conflicting Circle Lanes	1	1	1	1
Adj Approach Flow, veh/h	669	250	49	647
Demand Flow Rate, veh/h	682	255	50	659
Vehicles Circulating, veh/h	527	22	632	277
Vehicles Exiting, veh/h	409	660	577	0
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	28.3	4.3	5.8	12.6
Approach LOS	D	A	A	B
Lane	Left	Left	Left	Left
Designated Moves	TR	LT	LR	LTR
Assumed Moves	TR	LT	LR	LTR
RT Channelized				
Lane Util	1.000	1.000	1.000	1.000
Follow-Up Headway, s	2.609	2.609	2.609	2.609
Critical Headway, s	4.976	4.976	4.976	4.976
Entry Flow, veh/h	682	255	50	659
Cap Entry Lane, veh/h	806	1349	724	1040
Entry HV Adj Factor	0.981	0.979	0.980	0.982
Flow Entry, veh/h	669	250	49	647
Cap Entry, veh/h	791	1322	710	1021
V/C Ratio	0.846	0.189	0.069	0.633
Control Delay, s/veh	28.3	4.3	5.8	12.6
LOS	D	A	A	B
95th %tile Queue, veh	10	1	0	5

Intersection				
Intersection Delay, s/veh	3.2			
Intersection LOS	A			
Approach	EB	WB	NB	SB
Entry Lanes	1	1	1	1
Conflicting Circle Lanes	1	1	1	1
Adj Approach Flow, veh/h	0	71	54	71
Demand Flow Rate, veh/h	0	72	56	72
Vehicles Circulating, veh/h	144	28	0	72
Vehicles Exiting, veh/h	0	28	144	28
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	0.0	3.1	3.0	3.3
Approach LOS	-	A	A	A
Lane	Left	Left	Left	Left
Designated Moves	LTR	LTR	LTR	LTR
Assumed Moves	LTR	LTR	LTR	LTR
RT Channelized				
Lane Util	1.000	1.000	1.000	1.000
Follow-Up Headway, s	2.609	2.609	2.609	2.609
Critical Headway, s	4.976	4.976	4.976	4.976
Entry Flow, veh/h	0	72	56	72
Cap Entry Lane, veh/h	1191	1341	1380	1282
Entry HV Adj Factor	1.000	0.986	0.972	0.980
Flow Entry, veh/h	0	71	54	71
Cap Entry, veh/h	1191	1322	1342	1257
V/C Ratio	0.000	0.054	0.041	0.056
Control Delay, s/veh	3.0	3.1	3.0	3.3
LOS	A	A	A	A
95th %tile Queue, veh	0	0	0	0



APPENDIX C

LEVEL OF SERVICE CALCULATIONS

- Future Year 2027 (Without Bypass) PM Peak
-
-

Intersection						
Int Delay, s/veh	0.5					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	W		T			T
Traffic Vol, veh/h	10	0	175	20	5	95
Future Vol, veh/h	10	0	175	20	5	95
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	11	0	190	22	5	103

Major/Minor	Minor1	Major1	Major2			
Conflicting Flow All	314	201	0	0	212	0
Stage 1	201	-	-	-	-	-
Stage 2	113	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	679	840	-	-	1358	-
Stage 1	833	-	-	-	-	-
Stage 2	912	-	-	-	-	-
Platoon blocked, %			-	-		
Mov Cap-1 Maneuver	676	840	-	-	1358	-
Mov Cap-2 Maneuver	676	-	-	-	-	-
Stage 1	830	-	-	-	-	-
Stage 2	912	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	10.4	0	0.4
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBRWBLn1	SBL	SBT
Capacity (veh/h)	-	-	676	1358
HCM Lane V/C Ratio	-	-	0.016	0.004
HCM Control Delay (s)	-	-	10.4	7.7
HCM Lane LOS	-	-	B	A
HCM 95th %tile Q(veh)	-	-	0	0

Intersection												
Int Delay, s/veh	51.3											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕		↕	↕		↕	↕	
Traffic Vol, veh/h	15	0	105	30	5	10	175	810	25	20	905	30
Future Vol, veh/h	15	0	105	30	5	10	175	810	25	20	905	30
Conflicting Peds, #/hr	1	0	0	0	0	1	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None									
Storage Length	-	-	-	-	-	-	150	-	-	150	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	16	0	114	33	5	11	190	880	27	22	984	33

Major/Minor	Minor2		Minor1		Major1		Major2					
Conflicting Flow All	2328	2332	1001	2376	2335	895	1017	0	0	907	0	0
Stage 1	1045	1045	-	1274	1274	-	-	-	-	-	-	-
Stage 2	1283	1287	-	1102	1061	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	26	37	295	~ 24	37	339	682	-	-	750	-	-
Stage 1	276	306	-	205	238	-	-	-	-	-	-	-
Stage 2	203	235	-	257	300	-	-	-	-	-	-	-
Platoon blocked, %								-	-	-	-	-
Mov Cap-1 Maneuver	~ 16	26	295	~ 11	26	339	682	-	-	750	-	-
Mov Cap-2 Maneuver	~ 16	26	-	~ 11	26	-	-	-	-	-	-	-
Stage 1	199	297	-	148	172	-	-	-	-	-	-	-
Stage 2	137	169	-	153	291	-	-	-	-	-	-	-

Approach	EB		WB		NB		SB	
HCM Control Delay, s\$	314.9		\$ 1535.3		2.1		0.2	
HCM LOS	F		F					

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1WBLn1	SBL	SBT	SBR
Capacity (veh/h)	682	-	-	93	15	750	-
HCM Lane V/C Ratio	0.279	-	-	1.403	3.261	0.029	-
HCM Control Delay (s)	12.3	-	-	\$ 314.9	\$ 1535.3	9.9	-
HCM Lane LOS	B	-	-	F	F	A	-
HCM 95th %tile Q(veh)	1.1	-	-	9.7	6.9	0.1	-

Notes
 -: Volume exceeds capacity \$: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

Intersection			
Intersection Delay, s/veh	17.0		
Intersection LOS	C		
Approach	EB	NB	SB
Entry Lanes	1	1	1
Conflicting Circle Lanes	1	1	1
Adj Approach Flow, veh/h	326	979	1055
Demand Flow Rate, veh/h	332	999	1076
Vehicles Circulating, veh/h	887	177	34
Vehicles Exiting, veh/h	223	1042	1142
Ped Vol Crossing Leg, #/h	1	0	0
Ped Cap Adj	1.000	1.000	1.000
Approach Delay, s/veh	16.2	19.6	14.8
Approach LOS	C	C	B
Lane	Left	Left	Left
Designated Moves	LR	LT	TR
Assumed Moves	LR	LT	TR
RT Channelized			
Lane Util	1.000	1.000	1.000
Follow-Up Headway, s	2.500	2.500	2.500
Critical Headway, s	4.800	4.800	4.800
Entry Flow, veh/h	332	999	1076
Cap Entry Lane, veh/h	600	1209	1393
Entry HV Adj Factor	0.982	0.980	0.980
Flow Entry, veh/h	326	979	1055
Cap Entry, veh/h	590	1185	1365
V/C Ratio	0.553	0.826	0.773
Control Delay, s/veh	16.2	19.6	14.8
LOS	C	C	B
95th %tile Queue, veh	3	10	8

Intersection						
Int Delay, s/veh	5					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↔		↔	↑	↑	
Traffic Vol, veh/h	0	170	245	895	990	15
Future Vol, veh/h	0	170	245	895	990	15
Conflicting Peds, #/hr	8	0	8	0	0	8
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	0	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	185	266	973	1076	16

Major/Minor	Minor2	Major1	Major2			
Conflicting Flow All	2605	1092	1100	0	-	0
Stage 1	1092	-	-	-	-	-
Stage 2	1513	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	27	261	635	-	-	-
Stage 1	322	-	-	-	-	-
Stage 2	201	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	15	259	630	-	-	-
Mov Cap-2 Maneuver	15	-	-	-	-	-
Stage 1	185	-	-	-	-	-
Stage 2	199	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	47.3	3.2	0
HCM LOS	E		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	630	-	259	-	-
HCM Lane V/C Ratio	0.423	-	0.713	-	-
HCM Control Delay (s)	14.8	-	47.3	-	-
HCM Lane LOS	B	-	E	-	-
HCM 95th %tile Q(veh)	2.1	-	4.9	-	-

Intersection						
Int Delay, s/veh	7.5					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	T			T		T
Traffic Vol, veh/h	5	95	100	1165	1175	15
Future Vol, veh/h	5	95	100	1165	1175	15
Conflicting Peds, #/hr	0	0	8	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	5	103	109	1266	1277	16

Major/Minor	Minor2	Major1	Major2			
Conflicting Flow All	2144	1293	1301	0	-	0
Stage 1	1293	-	-	-	-	-
Stage 2	851	-	-	-	-	-
Critical Hdwy	6.63	6.23	4.13	-	-	-
Critical Hdwy Stg 1	5.43	-	-	-	-	-
Critical Hdwy Stg 2	5.83	-	-	-	-	-
Follow-up Hdwy	3.519	3.319	2.219	-	-	-
Pot Cap-1 Maneuver	47	198	530	-	-	-
Stage 1	256	-	-	-	-	-
Stage 2	380	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	14	196	526	-	-	-
Mov Cap-2 Maneuver	14	-	-	-	-	-
Stage 1	77	-	-	-	-	-
Stage 2	377	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	129	4.9	0
HCM LOS	F		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	526	-	119	-	-
HCM Lane V/C Ratio	0.207	-	0.913	-	-
HCM Control Delay (s)	13.6	4.1	129	-	-
HCM Lane LOS	B	A	F	-	-
HCM 95th %tile Q(veh)	0.8	-	5.8	-	-

HCM Unsignalized Intersection Capacity Analysis
6: Kuhio Hwy & Cane Haul Rd

Kealia Mauka Homesites
01/24/2018



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations				↕↕	↔	
Traffic Volume (veh/h)	0	0	15	1275	895	375
Future Volume (Veh/h)	0	0	15	1275	895	375
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)	0	0	16	1386	973	408
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	1902	1177	1381			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1902	1177	1381			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	100	100	97			
cM capacity (veh/h)	59	184	492			
Direction, Lane #	NB 1	NB 2	SB 1			
Volume Total	478	924	1381			
Volume Left	16	0	0			
Volume Right	0	0	408			
cSH	492	1700	1700			
Volume to Capacity	0.03	0.54	0.81			
Queue Length 95th (ft)	3	0	0			
Control Delay (s)	1.0	0.0	0.0			
Lane LOS	A					
Approach Delay (s)	0.3		0.0			
Approach LOS						
Intersection Summary						
Average Delay			0.2			
Intersection Capacity Utilization			73.3%	ICU Level of Service		D
Analysis Period (min)			15			

Intersection						
Int Delay, s/veh	8.3					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	170	10	20	1115	735	175
Future Vol, veh/h	170	10	20	1115	735	175
Conflicting Peds, #/hr	0	0	8	0	0	8
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	150	-	-	-
Veh in Median Storage, #	2	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	185	11	22	1212	799	190

Major/Minor	Minor2	Major1	Major2			
Conflicting Flow All	2158	902	997	0	-	0
Stage 1	902	-	-	-	-	-
Stage 2	1256	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	~ 52	336	694	-	-	-
Stage 1	396	-	-	-	-	-
Stage 2	268	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	~ 50	333	689	-	-	-
Mov Cap-2 Maneuver	199	-	-	-	-	-
Stage 1	380	-	-	-	-	-
Stage 2	266	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	101.2	0.2	0
HCM LOS	F		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	689	-	204	-	-
HCM Lane V/C Ratio	0.032	-	0.959	-	-
HCM Control Delay (s)	10.4	-	101.2	-	-
HCM Lane LOS	B	-	F	-	-
HCM 95th %tile Q(veh)	0.1	-	8.1	-	-

Notes
 -: Volume exceeds capacity \$: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

Intersection												
Int Delay, s/veh	11.5											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	45	5	25	5	5	110	20	985	15	40	705	15
Future Vol, veh/h	45	5	25	5	5	110	20	985	15	40	705	15
Conflicting Peds, #/hr	0	0	34	34	0	0	30	0	35	35	0	30
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None									
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	2	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	49	5	27	5	5	120	22	1071	16	43	766	16

Major/Minor	Minor2		Minor1		Major1		Major2					
Conflicting Flow All	2076	2056	838	2068	2056	1114	812	0	0	1122	0	0
Stage 1	890	890	-	1158	1158	-	-	-	-	-	-	-
Stage 2	1186	1166	-	910	898	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	~ 39	55	366	40	55	253	814	-	-	623	-	-
Stage 1	337	361	-	239	270	-	-	-	-	-	-	-
Stage 2	230	268	-	329	358	-	-	-	-	-	-	-
Platoon blocked, %								-	-	-	-	-
Mov Cap-1 Maneuver	~ 15	42	344	29	42	245	791	-	-	602	-	-
Mov Cap-2 Maneuver	60	161	-	29	42	-	-	-	-	-	-	-
Stage 1	304	306	-	215	242	-	-	-	-	-	-	-
Stage 2	107	241	-	251	304	-	-	-	-	-	-	-

Approach	EB		WB		NB		SB	
HCM Control Delay, s	161		83.2		0.2		0.6	
HCM LOS	F		F					

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1WBLn1	SBL	SBT	SBR
Capacity (veh/h)	791	-	-	88	162	602	-
HCM Lane V/C Ratio	0.027	-	-	0.926	0.805	0.072	-
HCM Control Delay (s)	9.7	0	-	161	83.2	11.4	0
HCM Lane LOS	A	A	-	F	F	B	A
HCM 95th %tile Q(veh)	0.1	-	-	5.1	5.3	0.2	-

Notes
 -: Volume exceeds capacity \$: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

HCM Signalized Intersection Capacity Analysis
9: Kuhio Hwy & Kukui St

Kealia Mauka Homesites
01/24/2018



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	235	65	35	800	685	55
Future Volume (vph)	235	65	35	800	685	55
Ideal Flow (vphpl)	1900	1900	1900	1000	1200	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	
Frbp, ped/bikes	1.00	0.79	1.00	1.00	0.99	
Flpb, ped/bikes	0.86	1.00	1.00	1.00	1.00	
Frt	1.00	0.85	1.00	1.00	0.99	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1516	1248	1770	800	1149	
Flt Permitted	0.95	1.00	0.26	1.00	1.00	
Satd. Flow (perm)	1516	1248	492	980	1149	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	255	71	38	870	745	60
RTOR Reduction (vph)	0	53	0	0	1	0
Lane Group Flow (vph)	255	18	38	870	804	0
Confl. Peds. (#/hr)	30	41	46			46
Turn Type	Perm	Perm	pm+pt	NA	NA	
Protected Phases			5	2	6	
Permitted Phases	4	4	2			
Actuated Green, G (s)	37.5	37.5	164.5	164.5	156.4	
Effective Green, g (s)	37.5	37.5	164.5	164.5	156.4	
Actuated g/C Ratio	0.18	0.18	0.78	0.78	0.74	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	270	222	410	626	855	
v/s Ratio Prot			0.00	c1.09	0.70	
v/s Ratio Perm	c0.17	0.01	0.07			
v/c Ratio	0.94	0.08	0.09	1.39	0.94	
Uniform Delay, d1	85.2	71.9	9.8	22.8	22.8	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	39.6	0.2	0.1	185.1	19.3	
Delay (s)	124.9	72.1	9.9	207.9	42.1	
Level of Service	F	E	A	F	D	
Approach Delay (s)	113.4			199.6	42.1	
Approach LOS	F			F	D	

Intersection Summary

HCM 2000 Control Delay	123.6	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.33		
Actuated Cycle Length (s)	210.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	103.6%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

Intersection				
Intersection Delay, s/veh	11.5			
Intersection LOS	B			
Approach	EB	WB	NB	SB
Entry Lanes	1	1	1	1
Conflicting Circle Lanes	1	1	1	1
Adj Approach Flow, veh/h	451	511	304	501
Demand Flow Rate, veh/h	460	522	311	511
Vehicles Circulating, veh/h	434	78	500	600
Vehicles Exiting, veh/h	677	733	394	0
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	11.1	6.9	9.0	18.2
Approach LOS	B	A	A	C
Lane	Left	Left	Left	Left
Designated Moves	TR	LT	LR	LTR
Assumed Moves	TR	LT	LR	LTR
RT Channelized				
Lane Util	1.000	1.000	1.000	1.000
Follow-Up Headway, s	2.609	2.609	2.609	2.609
Critical Headway, s	4.976	4.976	4.976	4.976
Entry Flow, veh/h	460	522	311	511
Cap Entry Lane, veh/h	886	1274	829	748
Entry HV Adj Factor	0.980	0.980	0.977	0.980
Flow Entry, veh/h	451	511	304	501
Cap Entry, veh/h	869	1248	810	733
V/C Ratio	0.519	0.410	0.375	0.683
Control Delay, s/veh	11.1	6.9	9.0	18.2
LOS	B	A	A	C
95th %tile Queue, veh	3	2	2	5

Intersection				
Intersection Delay, s/veh	3.5			
Intersection LOS	A			
Approach	EB	WB	NB	SB
Entry Lanes	1	1	1	1
Conflicting Circle Lanes	1	1	1	1
Adj Approach Flow, veh/h	0	49	164	49
Demand Flow Rate, veh/h	0	50	168	50
Vehicles Circulating, veh/h	100	84	0	50
Vehicles Exiting, veh/h	0	84	100	84
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	0.0	3.2	3.6	3.1
Approach LOS	-	A	A	A
Lane	Left	Left	Left	Left
Designated Moves	LTR	LTR	LTR	LTR
Assumed Moves	LTR	LTR	LTR	LTR
RT Channelized				
Lane Util	1.000	1.000	1.000	1.000
Follow-Up Headway, s	2.609	2.609	2.609	2.609
Critical Headway, s	4.976	4.976	4.976	4.976
Entry Flow, veh/h	0	50	168	50
Cap Entry Lane, veh/h	1246	1267	1380	1311
Entry HV Adj Factor	1.000	0.980	0.978	0.980
Flow Entry, veh/h	0	49	164	49
Cap Entry, veh/h	1246	1241	1350	1286
V/C Ratio	0.000	0.039	0.122	0.038
Control Delay, s/veh	2.9	3.2	3.6	3.1
LOS	A	A	A	A
95th %tile Queue, veh	0	0	0	0



APPENDIX C

LEVEL OF SERVICE CALCULATIONS

- Future Year 2027 (With Bypass) AM Peak
-
-

Intersection						
Int Delay, s/veh	1.2					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	Y		B			A
Traffic Vol, veh/h	20	5	50	15	5	140
Future Vol, veh/h	20	5	50	15	5	140
Conflicting Peds, #/hr	1	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	22	5	54	16	5	152

Major/Minor	Minor1	Major1	Major2			
Conflicting Flow All	225	62	0	0	70	0
Stage 1	62	-	-	-	-	-
Stage 2	163	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	763	1003	-	-	1531	-
Stage 1	961	-	-	-	-	-
Stage 2	866	-	-	-	-	-
Platoon blocked, %			-	-		
Mov Cap-1 Maneuver	759	1003	-	-	1531	-
Mov Cap-2 Maneuver	759	-	-	-	-	-
Stage 1	957	-	-	-	-	-
Stage 2	865	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	9.7	0	0.3
HCM LOS	A		

Minor Lane/Major Mvmt	NBT	NBRWBLn1	SBL	SBT
Capacity (veh/h)	-	-	798	1531
HCM Lane V/C Ratio	-	-	0.034	0.004
HCM Control Delay (s)	-	-	9.7	7.4
HCM Lane LOS	-	-	A	A
HCM 95th %tile Q(veh)	-	-	0.1	0

Intersection												
Int Delay, s/veh	31.8											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕		↕	↕		↕	↕	
Traffic Vol, veh/h	45	0	120	20	5	10	60	745	30	10	805	15
Future Vol, veh/h	45	0	120	20	5	10	60	745	30	10	805	15
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None									
Storage Length	-	-	-	-	-	-	150	-	-	150	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	49	0	130	22	5	11	65	810	33	11	875	16

Major/Minor	Minor2		Minor1		Major1			Major2				
Conflicting Flow All	1870	1878	883	1927	1870	827	891	0	0	843	0	0
Stage 1	905	905	-	957	957	-	-	-	-	-	-	-
Stage 2	965	973	-	970	913	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	55	71	345	50	72	371	761	-	-	793	-	-
Stage 1	331	355	-	310	336	-	-	-	-	-	-	-
Stage 2	306	330	-	304	352	-	-	-	-	-	-	-
Platoon blocked, %								-	-	-	-	-
Mov Cap-1 Maneuver	~ 46	64	345	29	65	371	761	-	-	793	-	-
Mov Cap-2 Maneuver	~ 46	64	-	29	65	-	-	-	-	-	-	-
Stage 1	303	350	-	284	307	-	-	-	-	-	-	-
Stage 2	267	302	-	186	347	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s\$	304.7	237.4	0.7	0.1
HCM LOS	F	F		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1WBLn1	SBL	SBT	SBR
Capacity (veh/h)	761	-	-	124	44	793	-
HCM Lane V/C Ratio	0.086	-	-	1.446	0.865	0.014	-
HCM Control Delay (s)	10.2	-	-	\$ 304.7	237.4	9.6	-
HCM Lane LOS	B	-	-	F	F	A	-
HCM 95th %tile Q(veh)	0.3	-	-	12.4	3.4	0	-

Notes
 -: Volume exceeds capacity \$: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

Intersection			
Intersection Delay, s/veh	17.8		
Intersection LOS	C		
Approach	EB	NB	SB
Entry Lanes	1	1	1
Conflicting Circle Lanes	1	1	1
Adj Approach Flow, veh/h	479	696	1005
Demand Flow Rate, veh/h	488	710	1025
Vehicles Circulating, veh/h	820	327	111
Vehicles Exiting, veh/h	316	981	926
Ped Vol Crossing Leg, #/h	0	0	0
Ped Cap Adj	1.000	1.000	1.000
Approach Delay, s/veh	25.4	14.1	16.7
Approach LOS	D	B	C
Lane	Left	Left	Left
Designated Moves	LR	LT	TR
Assumed Moves	LR	LT	TR
RT Channelized			
Lane Util	1.000	1.000	1.000
Follow-Up Headway, s	2.500	2.500	2.500
Critical Headway, s	4.800	4.800	4.800
Entry Flow, veh/h	488	710	1025
Cap Entry Lane, veh/h	641	1043	1291
Entry HV Adj Factor	0.982	0.981	0.980
Flow Entry, veh/h	479	696	1005
Cap Entry, veh/h	630	1023	1265
V/C Ratio	0.761	0.681	0.794
Control Delay, s/veh	25.4	14.1	16.7
LOS	D	B	C
95th %tile Queue, veh	7	6	9

Intersection						
Int Delay, s/veh	11.4					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↔		↔	↑	↑	
Traffic Vol, veh/h	5	220	280	575	835	30
Future Vol, veh/h	5	220	280	575	835	30
Conflicting Peds, #/hr	9	0	8	0	0	8
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	100	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	5	239	304	625	908	33

Major/Minor	Minor2	Major1	Major2			
Conflicting Flow All	2175	933	949	0	-	0
Stage 1	933	-	-	-	-	-
Stage 2	1242	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	51	323	724	-	-	-
Stage 1	383	-	-	-	-	-
Stage 2	272	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	29	321	718	-	-	-
Mov Cap-2 Maneuver	29	-	-	-	-	-
Stage 1	219	-	-	-	-	-
Stage 2	270	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	81.2	4.5	0
HCM LOS	F		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	718	-	262	-	-
HCM Lane V/C Ratio	0.424	-	0.933	-	-
HCM Control Delay (s)	13.7	-	81.2	-	-
HCM Lane LOS	B	-	F	-	-
HCM 95th %tile Q(veh)	2.1	-	8.5	-	-

Intersection						
Int Delay, s/veh	20					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↔	↔		↔	
Traffic Vol, veh/h	130	80	395	35	110	280
Future Vol, veh/h	130	80	395	35	110	280
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	141	87	429	38	120	304

Major/Minor	Major1	Major2	Minor2		
Conflicting Flow All	467	0	-	0	817
Stage 1	-	-	-	-	448
Stage 2	-	-	-	-	369
Critical Hdwy	4.12	-	-	-	6.42
Critical Hdwy Stg 1	-	-	-	-	5.42
Critical Hdwy Stg 2	-	-	-	-	5.42
Follow-up Hdwy	2.218	-	-	-	3.518
Pot Cap-1 Maneuver	1094	-	-	-	346
Stage 1	-	-	-	-	644
Stage 2	-	-	-	-	699
Platoon blocked, %		-	-	-	
Mov Cap-1 Maneuver	1094	-	-	-	299
Mov Cap-2 Maneuver	-	-	-	-	299
Stage 1	-	-	-	-	557
Stage 2	-	-	-	-	699

Approach	EB	WB	SB
HCM Control Delay, s	5.4	0	49.8
HCM LOS			E

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1094	-	-	-	472
HCM Lane V/C Ratio	0.129	-	-	-	0.898
HCM Control Delay (s)	8.8	0	-	-	49.8
HCM Lane LOS	A	A	-	-	E
HCM 95th %tile Q(veh)	0.4	-	-	-	10

Intersection

Int Delay, s/veh 6.6

Movement EBL EBR NBL NBT SBT SBR

Lane Configurations						
Traffic Vol, veh/h	85	105	45	885	780	375
Future Vol, veh/h	85	105	45	885	780	375
Conflicting Peds, #/hr	9	0	4	0	0	4
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	2	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	92	114	49	962	848	408

Major/Minor Minor2 Major1 Major2

Conflicting Flow All	2125	1056	1260	0	-	0
Stage 1	1056	-	-	-	-	-
Stage 2	1069	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	~ 55	274	552	-	-	-
Stage 1	335	-	-	-	-	-
Stage 2	330	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	~ 50	273	550	-	-	-
Mov Cap-2 Maneuver	200	-	-	-	-	-
Stage 1	304	-	-	-	-	-
Stage 2	329	-	-	-	-	-

Approach EB NB SB

HCM Control Delay, s	75.5	0.6	0
HCM LOS	F		

Minor Lane/Major Mvmt NBL NBT EBLn1 SBT SBR

Capacity (veh/h)	550	-	235	-	-
HCM Lane V/C Ratio	0.089	-	0.879	-	-
HCM Control Delay (s)	12.2	-	75.5	-	-
HCM Lane LOS	B	-	F	-	-
HCM 95th %tile Q(veh)	0.3	-	7.2	-	-

Notes

~: Volume exceeds capacity \$: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

Intersection						
Int Delay, s/veh	3.9					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	W		W	↑	↑	
Traffic Vol, veh/h	165	10	5	800	765	80
Future Vol, veh/h	165	10	5	800	765	80
Conflicting Peds, #/hr	0	0	5	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	150	-	-	-
Veh in Median Storage, #	2	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	179	11	5	870	832	87

Major/Minor	Minor2	Major1	Major2			
Conflicting Flow All	1761	881	924	0	-	0
Stage 1	881	-	-	-	-	-
Stage 2	880	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	~ 93	346	739	-	-	-
Stage 1	405	-	-	-	-	-
Stage 2	406	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	~ 91	344	735	-	-	-
Mov Cap-2 Maneuver	282	-	-	-	-	-
Stage 1	400	-	-	-	-	-
Stage 2	404	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	39.7	0.1	0
HCM LOS	E		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	735	-	285	-	-
HCM Lane V/C Ratio	0.007	-	0.667	-	-
HCM Control Delay (s)	9.9	-	39.7	-	-
HCM Lane LOS	A	-	E	-	-
HCM 95th %tile Q(veh)	0	-	4.4	-	-

Notes
 -: Volume exceeds capacity \$: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

Intersection												
Int Delay, s/veh	2.5											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	5	5	10	5	5	55	10	735	5	70	700	5
Future Vol, veh/h	5	5	10	5	5	55	10	735	5	70	700	5
Conflicting Peds, #/hr	0	0	13	13	0	0	12	0	14	14	0	12
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None									
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	5	5	11	5	5	60	11	799	5	76	761	5

Major/Minor	Minor2		Minor1		Major1		Major2					
Conflicting Flow All	1784	1768	789	1775	1768	816	778	0	0	818	0	0
Stage 1	928	928	-	838	838	-	-	-	-	-	-	-
Stage 2	856	840	-	937	930	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	63	84	391	64	84	377	839	-	-	810	-	-
Stage 1	321	347	-	361	382	-	-	-	-	-	-	-
Stage 2	352	381	-	318	346	-	-	-	-	-	-	-
Platoon blocked, %								-	-	-	-	-
Mov Cap-1 Maneuver	42	67	382	49	67	372	829	-	-	799	-	-
Mov Cap-2 Maneuver	42	67	-	49	67	-	-	-	-	-	-	-
Stage 1	310	286	-	348	368	-	-	-	-	-	-	-
Stage 2	284	367	-	250	285	-	-	-	-	-	-	-

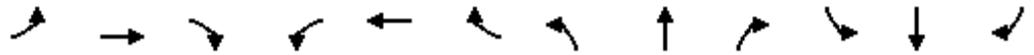
Approach	EB		WB		NB		SB	
HCM Control Delay, s	56.6		32.5		0.1		0.9	
HCM LOS	F		D					

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1WBLn1	SBL	SBT	SBR
Capacity (veh/h)	829	-	-	91	200	799	-
HCM Lane V/C Ratio	0.013	-	-	0.239	0.353	0.095	-
HCM Control Delay (s)	9.4	0	-	56.6	32.5	10	0
HCM Lane LOS	A	A	-	F	D	A	A
HCM 95th %tile Q(veh)	0	-	-	0.9	1.5	0.3	-

HCM Signalized Intersection Capacity Analysis
 9: Kuhio Hwy & Kukui St

Kealia Mauka Homesites

01/24/2018



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕	↗			↖	↖	↖			↕	
Traffic Volume (vph)	40	5	60	0	0	15	25	705	20	0	670	35
Future Volume (vph)	40	5	60	0	0	15	25	705	20	0	670	35
Ideal Flow (vphp)	1900	1900	1900	1900	1900	1900	1900	1200	1900	1900	1200	1900
Total Lost time (s)		4.0	4.0			4.0	4.0	4.0			4.0	
Lane Util. Factor		1.00	1.00			1.00	1.00	1.00			1.00	
Frbp, ped/bikes		1.00	0.95			0.94	1.00	1.00			1.00	
Flpb, ped/bikes		0.97	1.00			1.00	1.00	1.00			1.00	
Frt		1.00	0.85			0.86	1.00	1.00			0.99	
Flt Protected		0.96	1.00			1.00	0.95	1.00			1.00	
Satd. Flow (prot)		1737	1500			1509	1769	1169			1167	
Flt Permitted		0.96	1.00			1.00	0.33	1.00			1.00	
Satd. Flow (perm)		1737	1500			1509	610	1169			1167	
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)	43	5	65	0	0	16	27	766	22	0	728	38
RTOR Reduction (vph)	0	0	61	0	0	15	0	0	0	0	1	0
Lane Group Flow (vph)	0	48	4	0	0	1	27	788	0	0	765	0
Confl. Peds. (#/hr)	6		7			6	2		13	13		2
Turn Type	Perm	NA	Perm			Perm	pm+pt	NA			NA	
Protected Phases		4					5	2				6
Permitted Phases	4		4			8	2			6		
Actuated Green, G (s)		14.3	14.3			14.3	187.7	187.7			178.9	
Effective Green, g (s)		14.3	14.3			14.3	187.7	187.7			178.9	
Actuated g/C Ratio		0.07	0.07			0.07	0.89	0.89			0.85	
Clearance Time (s)		4.0	4.0			4.0	4.0	4.0			4.0	
Vehicle Extension (s)		3.0	3.0			3.0	3.0	3.0			3.0	
Lane Grp Cap (vph)		118	102			102	571	1044			994	
v/s Ratio Prot							0.00	c0.67			c0.66	
v/s Ratio Perm		0.03	0.00			0.00	0.04					
v/c Ratio		0.41	0.04			0.01	0.05	0.75			0.77	
Uniform Delay, d1		93.8	91.5			91.3	2.5	3.6			6.7	
Progression Factor		1.00	1.00			1.00	1.00	1.00			1.00	
Incremental Delay, d2		2.3	0.2			0.0	0.0	5.1			5.7	
Delay (s)		96.1	91.6			91.3	2.6	8.7			12.4	
Level of Service		F	F			F	A	A			B	
Approach Delay (s)		93.5			91.3			8.5			12.4	
Approach LOS		F			F			A			B	

Intersection Summary		
HCM 2000 Control Delay	16.7	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.75	B
Actuated Cycle Length (s)	210.0	Sum of lost time (s)
Intersection Capacity Utilization	82.0%	12.0
Analysis Period (min)	15	ICU Level of Service
c Critical Lane Group		D

Intersection				
Intersection Delay, s/veh 27.2				
Intersection LOS D				
Approach	EB	WB	NB	SB
Entry Lanes	1	1	1	1
Conflicting Circle Lanes	1	1	1	1
Adj Approach Flow, veh/h	685	255	49	793
Demand Flow Rate, veh/h	698	260	49	809
Vehicles Circulating, veh/h	621	243	670	277
Vehicles Exiting, veh/h	465	476	649	226
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	46.7	5.7	5.9	18.5
Approach LOS	E	A	A	C
Lane	Left	Left	Left	Left
Designated Moves	LTR	LTR	LTR	LTR
Assumed Moves	LTR	LTR	LTR	LTR
RT Channelized				
Lane Util	1.000	1.000	1.000	1.000
Follow-Up Headway, s	2.609	2.609	2.609	2.609
Critical Headway, s	4.976	4.976	4.976	4.976
Entry Flow, veh/h	698	260	49	809
Cap Entry Lane, veh/h	732	1077	697	1040
Entry HV Adj Factor	0.981	0.980	0.994	0.981
Flow Entry, veh/h	685	255	49	793
Cap Entry, veh/h	719	1055	692	1020
V/C Ratio	0.953	0.241	0.070	0.778
Control Delay, s/veh	46.7	5.7	5.9	18.5
LOS	E	A	A	C
95th %tile Queue, veh	14	1	0	8

Intersection				
Intersection Delay, s/veh	3.2			
Intersection LOS	A			
Approach	EB	WB	NB	SB
Entry Lanes	1	1	1	1
Conflicting Circle Lanes	1	1	1	1
Adj Approach Flow, veh/h	15	81	59	81
Demand Flow Rate, veh/h	15	82	61	82
Vehicles Circulating, veh/h	149	38	15	82
Vehicles Exiting, veh/h	15	38	149	38
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	3.2	3.2	3.1	3.4
Approach LOS	A	A	A	A
Lane	Left	Left	Left	Left
Designated Moves	LTR	LTR	LTR	LTR
Assumed Moves	LTR	LTR	LTR	LTR
RT Channelized				
Lane Util	1.000	1.000	1.000	1.000
Follow-Up Headway, s	2.609	2.609	2.609	2.609
Critical Headway, s	4.976	4.976	4.976	4.976
Entry Flow, veh/h	15	82	61	82
Cap Entry Lane, veh/h	1185	1327	1359	1269
Entry HV Adj Factor	0.993	0.987	0.975	0.983
Flow Entry, veh/h	15	81	59	81
Cap Entry, veh/h	1178	1310	1324	1247
V/C Ratio	0.013	0.062	0.045	0.065
Control Delay, s/veh	3.2	3.2	3.1	3.4
LOS	A	A	A	A
95th %tile Queue, veh	0	0	0	0



APPENDIX C

LEVEL OF SERVICE CALCULATIONS

- Future Year 2027 (With Bypass) PM Peak
-
-

Intersection						
Int Delay, s/veh	0.5					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	W		T			T
Traffic Vol, veh/h	10	0	175	20	5	95
Future Vol, veh/h	10	0	175	20	5	95
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	11	0	190	22	5	103

Major/Minor	Minor1	Major1	Major2			
Conflicting Flow All	314	201	0	0	212	0
Stage 1	201	-	-	-	-	-
Stage 2	113	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	679	840	-	-	1358	-
Stage 1	833	-	-	-	-	-
Stage 2	912	-	-	-	-	-
Platoon blocked, %			-	-	-	-
Mov Cap-1 Maneuver	676	840	-	-	1358	-
Mov Cap-2 Maneuver	676	-	-	-	-	-
Stage 1	830	-	-	-	-	-
Stage 2	912	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	10.4	0	0.4
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBRWBLn1	SBL	SBT
Capacity (veh/h)	-	-	676	1358
HCM Lane V/C Ratio	-	-	0.016	0.004
HCM Control Delay (s)	-	-	10.4	7.7
HCM Lane LOS	-	-	B	A
HCM 95th %tile Q(veh)	-	-	0	0

Intersection												
Int Delay, s/veh	51.3											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕		↕	↕		↕	↕	
Traffic Vol, veh/h	15	0	105	30	5	10	175	810	25	20	905	30
Future Vol, veh/h	15	0	105	30	5	10	175	810	25	20	905	30
Conflicting Peds, #/hr	1	0	0	0	0	1	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None									
Storage Length	-	-	-	-	-	-	150	-	-	150	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	16	0	114	33	5	11	190	880	27	22	984	33

Major/Minor	Minor2		Minor1		Major1		Major2					
Conflicting Flow All	2328	2332	1001	2376	2335	895	1017	0	0	907	0	0
Stage 1	1045	1045	-	1274	1274	-	-	-	-	-	-	-
Stage 2	1283	1287	-	1102	1061	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	26	37	295	~ 24	37	339	682	-	-	750	-	-
Stage 1	276	306	-	205	238	-	-	-	-	-	-	-
Stage 2	203	235	-	257	300	-	-	-	-	-	-	-
Platoon blocked, %								-	-	-	-	-
Mov Cap-1 Maneuver	~ 16	26	295	~ 11	26	339	682	-	-	750	-	-
Mov Cap-2 Maneuver	~ 16	26	-	~ 11	26	-	-	-	-	-	-	-
Stage 1	199	297	-	148	172	-	-	-	-	-	-	-
Stage 2	137	169	-	153	291	-	-	-	-	-	-	-

Approach	EB		WB		NB		SB	
HCM Control Delay, s\$	314.9		\$ 1535.3		2.1		0.2	
HCM LOS	F		F					

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1WBLn1	SBL	SBT	SBR
Capacity (veh/h)	682	-	-	93	15	750	-
HCM Lane V/C Ratio	0.279	-	-	1.403	3.261	0.029	-
HCM Control Delay (s)	12.3	-	-	\$ 314.9	\$ 1535.3	9.9	-
HCM Lane LOS	B	-	-	F	F	A	-
HCM 95th %tile Q(veh)	1.1	-	-	9.7	6.9	0.1	-

Notes			
-: Volume exceeds capacity	\$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

Intersection			
Intersection Delay, s/veh	17.3		
Intersection LOS	C		
Approach	EB	NB	SB
Entry Lanes	1	1	1
Conflicting Circle Lanes	1	1	1
Adj Approach Flow, veh/h	315	930	1055
Demand Flow Rate, veh/h	322	949	1076
Vehicles Circulating, veh/h	887	233	34
Vehicles Exiting, veh/h	223	976	1148
Ped Vol Crossing Leg, #/h	1	0	0
Ped Cap Adj	1.000	1.000	1.000
Approach Delay, s/veh	15.7	20.6	14.8
Approach LOS	C	C	B
Lane	Left	Left	Left
Designated Moves	LR	LT	TR
Assumed Moves	LR	LT	TR
RT Channelized			
Lane Util	1.000	1.000	1.000
Follow-Up Headway, s	2.500	2.500	2.500
Critical Headway, s	4.800	4.800	4.800
Entry Flow, veh/h	322	949	1076
Cap Entry Lane, veh/h	600	1144	1393
Entry HV Adj Factor	0.978	0.980	0.980
Flow Entry, veh/h	315	930	1055
Cap Entry, veh/h	587	1122	1365
V/C Ratio	0.536	0.829	0.773
Control Delay, s/veh	15.7	20.6	14.8
LOS	C	C	B
95th %tile Queue, veh	3	10	8

Intersection						
Int Delay, s/veh	3.5					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	0	145	210	850	925	15
Future Vol, veh/h	0	145	210	850	925	15
Conflicting Peds, #/hr	8	0	8	0	0	8
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	100	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	158	228	924	1005	16

Major/Minor	Minor2	Major1	Major2			
Conflicting Flow All	2409	1021	1029	0	-	0
Stage 1	1021	-	-	-	-	-
Stage 2	1388	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	36	287	675	-	-	-
Stage 1	348	-	-	-	-	-
Stage 2	231	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	23	285	670	-	-	-
Mov Cap-2 Maneuver	23	-	-	-	-	-
Stage 1	228	-	-	-	-	-
Stage 2	229	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	32.2	2.6	0
HCM LOS	D		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	670	-	285	-	-
HCM Lane V/C Ratio	0.341	-	0.553	-	-
HCM Control Delay (s)	13.1	-	32.2	-	-
HCM Lane LOS	B	-	D	-	-
HCM 95th %tile Q(veh)	1.5	-	3.1	-	-

Intersection						
Int Delay, s/veh	5.5					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↶	↷		↶	↷
Traffic Vol, veh/h	150	100	350	50	50	135
Future Vol, veh/h	150	100	350	50	50	135
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	163	109	380	54	54	147

Major/Minor	Major1	Major2	Minor2		
Conflicting Flow All	434	0	-	0	842
Stage 1	-	-	-	-	407
Stage 2	-	-	-	-	435
Critical Hdwy	4.12	-	-	-	6.42
Critical Hdwy Stg 1	-	-	-	-	5.42
Critical Hdwy Stg 2	-	-	-	-	5.42
Follow-up Hdwy	2.218	-	-	-	3.518
Pot Cap-1 Maneuver	1126	-	-	-	334
Stage 1	-	-	-	-	672
Stage 2	-	-	-	-	653
Platoon blocked, %		-	-	-	
Mov Cap-1 Maneuver	1126	-	-	-	283
Mov Cap-2 Maneuver	-	-	-	-	283
Stage 1	-	-	-	-	569
Stage 2	-	-	-	-	653

Approach	EB	WB	SB
HCM Control Delay, s	5.2	0	17.8
HCM LOS			C

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1126	-	-	-	479
HCM Lane V/C Ratio	0.145	-	-	-	0.42
HCM Control Delay (s)	8.7	0	-	-	17.8
HCM Lane LOS	A	A	-	-	C
HCM 95th %tile Q(veh)	0.5	-	-	-	2

Intersection						
Int Delay, s/veh	5.4					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	Y		Y	↑	↑	
Traffic Vol, veh/h	180	10	20	860	655	175
Future Vol, veh/h	180	10	20	860	655	175
Conflicting Peds, #/hr	0	0	8	0	0	8
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	150	-	-	-
Veh in Median Storage, #	2	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	196	11	22	935	712	190

Major/Minor	Minor2	Major1	Major2			
Conflicting Flow All	1794	815	910	0	-	0
Stage 1	815	-	-	-	-	-
Stage 2	979	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	~ 89	377	748	-	-	-
Stage 1	435	-	-	-	-	-
Stage 2	364	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	~ 85	374	742	-	-	-
Mov Cap-2 Maneuver	262	-	-	-	-	-
Stage 1	418	-	-	-	-	-
Stage 2	361	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	53.4	0.2	0
HCM LOS	F		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	742	-	266	-	-
HCM Lane V/C Ratio	0.029	-	0.776	-	-
HCM Control Delay (s)	10	-	53.4	-	-
HCM Lane LOS	A	-	F	-	-
HCM 95th %tile Q(veh)	0.1	-	5.8	-	-

Notes
 -: Volume exceeds capacity \$: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

Intersection												
Int Delay, s/veh	3.6											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	5	5	25	5	5	95	20	785	5	40	625	15
Future Vol, veh/h	5	5	25	5	5	95	20	785	5	40	625	15
Conflicting Peds, #/hr	0	0	34	34	0	0	30	0	35	35	0	30
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None									
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	5	5	27	5	5	103	22	853	5	43	679	16

Major/Minor	Minor2		Minor1		Major1		Major2					
Conflicting Flow All	1757	1740	751	1758	1746	891	725	0	0	893	0	0
Stage 1	803	803	-	935	935	-	-	-	-	-	-	-
Stage 2	954	937	-	823	811	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	66	87	411	66	86	341	878	-	-	759	-	-
Stage 1	377	396	-	318	344	-	-	-	-	-	-	-
Stage 2	311	343	-	368	393	-	-	-	-	-	-	-
Platoon blocked, %								-	-	-	-	-
Mov Cap-1 Maneuver	37	70	386	48	69	330	853	-	-	734	-	-
Mov Cap-2 Maneuver	37	70	-	48	69	-	-	-	-	-	-	-
Stage 1	348	348	-	292	316	-	-	-	-	-	-	-
Stage 2	200	316	-	295	345	-	-	-	-	-	-	-

Approach	EB		WB		NB		SB	
HCM Control Delay, s	44.2		36.1		0.2		0.6	
HCM LOS	E		E					

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1WBLn1	SBL	SBT	SBR
Capacity (veh/h)	853	-	-	129	226	734	-
HCM Lane V/C Ratio	0.025	-	-	0.295	0.505	0.059	-
HCM Control Delay (s)	9.3	0	-	44.2	36.1	10.2	0
HCM Lane LOS	A	A	-	E	E	B	A
HCM 95th %tile Q(veh)	0.1	-	-	1.1	2.6	0.2	-

HCM Signalized Intersection Capacity Analysis

9: Kuhio Hwy & Kukui St

Kealia Mauka Homesites

01/24/2018



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕	↗			↗	↖	↖			↕	
Traffic Volume (vph)	35	15	60	0	0	25	35	765	10	5	605	55
Future Volume (vph)	35	15	60	0	0	25	35	765	10	5	605	55
Ideal Flow (vphp)	1900	1900	1900	1900	1900	1900	1900	1200	1900	1900	1200	1900
Total Lost time (s)		4.0	4.0			4.0	4.0	4.0			4.0	
Lane Util. Factor		1.00	1.00			1.00	1.00	1.00			1.00	
Frbp, ped/bikes		1.00	0.87			0.88	1.00	1.00			0.99	
Flpb, ped/bikes		0.94	1.00			1.00	0.99	1.00			1.00	
Frt		1.00	0.85			0.86	1.00	1.00			0.99	
Flt Protected		0.97	1.00			1.00	0.95	1.00			1.00	
Satd. Flow (prot)		1696	1378			1418	1755	1172			1152	
Flt Permitted		0.97	1.00			1.00	0.35	1.00			1.00	
Satd. Flow (perm)		1696	1378			1418	648	1172			1147	
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	16	65	0	0	27	38	832	11	5	658	60
RTOR Reduction (vph)	0	0	55	0	0	23	0	0	0	0	2	0
Lane Group Flow (vph)	0	54	10	0	0	4	38	843	0	0	721	0
Confl. Peds. (#/hr)	30		41	41		30	46		68	68		46
Turn Type	Perm	NA	Perm			Perm	pm+pt	NA		Perm	NA	
Protected Phases		4					5	2				6
Permitted Phases	4		4			8	2			6		
Actuated Green, G (s)		17.6	17.6			17.6	94.4	94.4			86.5	
Effective Green, g (s)		17.6	17.6			17.6	94.4	94.4			86.5	
Actuated g/C Ratio		0.15	0.15			0.15	0.79	0.79			0.72	
Clearance Time (s)		4.0	4.0			4.0	4.0	4.0			4.0	
Vehicle Extension (s)		3.0	3.0			3.0	3.0	3.0			3.0	
Lane Grp Cap (vph)		248	202			207	545	921			826	
v/s Ratio Prot							0.00	c0.72				
v/s Ratio Perm		0.03	0.01			0.00	0.05				0.63	
v/c Ratio		0.22	0.05			0.02	0.07	0.92			0.87	
Uniform Delay, d1		45.1	44.0			43.8	3.7	9.7			12.6	
Progression Factor		1.00	1.00			1.00	1.00	1.00			1.00	
Incremental Delay, d2		0.4	0.1			0.0	0.1	15.1			12.3	
Delay (s)		45.6	44.1			43.9	3.8	24.8			24.9	
Level of Service		D	D			D	A	C			C	
Approach Delay (s)		44.8			43.9			23.9			24.9	
Approach LOS		D			D			C			C	

Intersection Summary

HCM 2000 Control Delay	26.1	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.83		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	93.7%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Intersection				
Intersection Delay, s/veh	16.5			
Intersection LOS	C			
Approach	EB	WB	NB	SB
Entry Lanes	1	1	1	1
Conflicting Circle Lanes	1	1	1	1
Adj Approach Flow, veh/h	461	516	315	603
Demand Flow Rate, veh/h	471	527	322	615
Vehicles Circulating, veh/h	505	349	532	600
Vehicles Exiting, veh/h	710	504	444	276
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	13.1	11.0	9.6	27.4
Approach LOS	B	B	A	D
Lane	Left	Left	Left	Left
Designated Moves	LTR	LTR	LTR	LTR
Assumed Moves	LTR	LTR	LTR	LTR
RT Channelized				
Lane Util	1.000	1.000	1.000	1.000
Follow-Up Headway, s	2.609	2.609	2.609	2.609
Critical Headway, s	4.976	4.976	4.976	4.976
Entry Flow, veh/h	471	527	322	615
Cap Entry Lane, veh/h	824	967	802	748
Entry HV Adj Factor	0.980	0.980	0.980	0.980
Flow Entry, veh/h	461	516	315	603
Cap Entry, veh/h	808	947	786	733
V/C Ratio	0.571	0.545	0.401	0.822
Control Delay, s/veh	13.1	11.0	9.6	27.4
LOS	B	B	A	D
95th %tile Queue, veh	4	3	2	9

Intersection				
Intersection Delay, s/veh	3.5			
Intersection LOS	A			
Approach	EB	WB	NB	SB
Entry Lanes	1	1	1	1
Conflicting Circle Lanes	1	1	1	1
Adj Approach Flow, veh/h	15	59	169	59
Demand Flow Rate, veh/h	15	60	173	60
Vehicles Circulating, veh/h	105	94	15	60
Vehicles Exiting, veh/h	15	94	105	94
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	3.0	3.3	3.7	3.2
Approach LOS	A	A	A	A
Lane	Left	Left	Left	Left
Designated Moves	LTR	LTR	LTR	LTR
Assumed Moves	LTR	LTR	LTR	LTR
RT Channelized				
Lane Util	1.000	1.000	1.000	1.000
Follow-Up Headway, s	2.609	2.609	2.609	2.609
Critical Headway, s	4.976	4.976	4.976	4.976
Entry Flow, veh/h	15	60	173	60
Cap Entry Lane, veh/h	1240	1254	1359	1298
Entry HV Adj Factor	0.993	0.982	0.979	0.984
Flow Entry, veh/h	15	59	169	59
Cap Entry, veh/h	1232	1231	1330	1277
V/C Ratio	0.012	0.048	0.127	0.046
Control Delay, s/veh	3.0	3.3	3.7	3.2
LOS	A	A	A	A
95th %tile Queue, veh	0	0	0	0



APPENDIX C

LEVEL OF SERVICE CALCULATIONS

- Future Year 2027 with Mitigation (Without Bypass) AM Peak
-
-

Intersection						
Int Delay, s/veh	1.2					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	20	5	50	15	5	140
Future Vol, veh/h	20	5	50	15	5	140
Conflicting Peds, #/hr	1	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	22	5	54	16	5	152

Major/Minor	Minor1	Major1	Major2			
Conflicting Flow All	225	62	0	0	70	0
Stage 1	62	-	-	-	-	-
Stage 2	163	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	763	1003	-	-	1531	-
Stage 1	961	-	-	-	-	-
Stage 2	866	-	-	-	-	-
Platoon blocked, %			-	-	-	-
Mov Cap-1 Maneuver	759	1003	-	-	1531	-
Mov Cap-2 Maneuver	759	-	-	-	-	-
Stage 1	957	-	-	-	-	-
Stage 2	865	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	9.7	0	0.3
HCM LOS	A		

Minor Lane/Major Mvmt	NBT	NBRWBLn1	SBL	SBT
Capacity (veh/h)	-	-	798	1531
HCM Lane V/C Ratio	-	-	0.034	0.004
HCM Control Delay (s)	-	-	9.7	7.4
HCM Lane LOS	-	-	A	A
HCM 95th %tile Q(veh)	-	-	0.1	0

Intersection				
Intersection Delay, s/veh	11.7			
Intersection LOS	B			
Approach	EB	NB	SB	
Entry Lanes	1	1	1	
Conflicting Circle Lanes	1	1	1	
Adj Approach Flow, veh/h	179	914	902	
Demand Flow Rate, veh/h	183	931	920	
Vehicles Circulating, veh/h	926	50	94	
Vehicles Exiting, veh/h	72	1059	887	
Ped Vol Crossing Leg, #/h	0	0	0	
Ped Cap Adj	1.000	1.000	1.000	
Approach Delay, s/veh	10.9	11.5	12.0	
Approach LOS	B	B	B	
Lane	Left	Left	Left	Bypass
Designated Moves	LR	LT	T	R
Assumed Moves	LR	LT	T	R
RT Channelized				Yield
Lane Util	1.000	1.000	1.000	
Follow-Up Headway, s	2.500	2.500	2.500	
Critical Headway, s	4.800	4.800	4.800	16
Entry Flow, veh/h	183	931	904	1341
Cap Entry Lane, veh/h	578	1371	1313	0.980
Entry HV Adj Factor	0.978	0.981	0.980	16
Flow Entry, veh/h	179	913	886	1315
Cap Entry, veh/h	565	1344	1287	0.012
V/C Ratio	0.317	0.679	0.689	2.8
Control Delay, s/veh	10.9	11.5	12.2	A
LOS	B	B	B	0
95th %tile Queue, veh	1	6	6	

Intersection			
Intersection Delay, s/veh	18.9		
Intersection LOS	C		
Approach	EB	NB	SB
Entry Lanes	1	1	1
Conflicting Circle Lanes	1	1	1
Adj Approach Flow, veh/h	511	734	1005
Demand Flow Rate, veh/h	522	749	1025
Vehicles Circulating, veh/h	820	289	111
Vehicles Exiting, veh/h	316	1053	926
Ped Vol Crossing Leg, #/h	0	0	0
Ped Cap Adj	1.000	1.000	1.000
Approach Delay, s/veh	30.0	14.1	16.7
Approach LOS	D	B	C
Lane	Left	Left	Left
Designated Moves	LR	LT	TR
Assumed Moves	LR	LT	TR
RT Channelized			
Lane Util	1.000	1.000	1.000
Follow-Up Headway, s	2.500	2.500	2.500
Critical Headway, s	4.800	4.800	4.800
Entry Flow, veh/h	522	749	1025
Cap Entry Lane, veh/h	641	1083	1291
Entry HV Adj Factor	0.979	0.981	0.980
Flow Entry, veh/h	511	734	1005
Cap Entry, veh/h	628	1062	1265
V/C Ratio	0.814	0.692	0.794
Control Delay, s/veh	30.0	14.1	16.7
LOS	D	B	C
95th %tile Queue, veh	8	6	9

Intersection						
Int Delay, s/veh	27.5					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	5	260	330	605	900	30
Future Vol, veh/h	5	260	330	605	900	30
Conflicting Peds, #/hr	9	0	8	0	0	8
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	0	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	5	283	359	658	978	33

Major/Minor	Minor2	Major1	Major2			
Conflicting Flow All	2388	1003	1019	0	-	0
Stage 1	1003	-	-	-	-	-
Stage 2	1385	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	37	294	681	-	-	-
Stage 1	355	-	-	-	-	-
Stage 2	232	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	17	292	676	-	-	-
Mov Cap-2 Maneuver	17	-	-	-	-	-
Stage 1	165	-	-	-	-	-
Stage 2	230	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	201.3	5.7	0
HCM LOS	F		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	676	-	224	-	-
HCM Lane V/C Ratio	0.531	-	1.286	-	-
HCM Control Delay (s)	16.2	-	201.3	-	-
HCM Lane LOS	C	-	F	-	-
HCM 95th %tile Q(veh)	3.1	-	15.1	-	-

Intersection						
Int Delay, s/veh	47.3					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	T			T		T
Traffic Vol, veh/h	10	270	70	975	1180	10
Future Vol, veh/h	10	270	70	975	1180	10
Conflicting Peds, #/hr	9	0	4	0	0	4
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	11	293	76	1060	1283	11

Major/Minor	Minor2	Major1	Major2			
Conflicting Flow All	1984	1293	1298	0	-	0
Stage 1	1293	-	-	-	-	-
Stage 2	691	-	-	-	-	-
Critical Hdwy	6.63	6.23	4.13	-	-	-
Critical Hdwy Stg 1	5.43	-	-	-	-	-
Critical Hdwy Stg 2	5.83	-	-	-	-	-
Follow-up Hdwy	3.519	3.319	2.219	-	-	-
Pot Cap-1 Maneuver	60	~ 198	532	-	-	-
Stage 1	256	-	-	-	-	-
Stage 2	460	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	39	~ 197	530	-	-	-
Mov Cap-2 Maneuver	39	-	-	-	-	-
Stage 1	166	-	-	-	-	-
Stage 2	458	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	\$ 415	2.7	0
HCM LOS	F		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	530	-	172	-	-
HCM Lane V/C Ratio	0.144	-	1.769	-	-
HCM Control Delay (s)	12.9	2	\$ 415	-	-
HCM Lane LOS	B	A	F	-	-
HCM 95th %tile Q(veh)	0.5	-	21.8	-	-

Notes
 -: Volume exceeds capacity \$: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

HCM Unsignalized Intersection Capacity Analysis
6: Kuhio Hwy & Cane Haul Rd

Kealia Mauka Homesites
11/05/2018



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations				↕↕	↕	
Traffic Volume (veh/h)	0	0	20	1110	1010	515
Future Volume (Veh/h)	0	0	20	1110	1010	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)	0	0	22	1207	1098	560
Pedestrians	4				9	
Lane Width (ft)	0.0				12.0	
Walking Speed (ft/s)	3.5				3.5	
Percent Blockage	0				1	
Right turn flare (veh)						
Median type				None	None	
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	2038	1382	1662			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	2038	1382	1662			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	100	100	94			
cM capacity (veh/h)	46	134	383			
Direction, Lane #	NB 1	NB 2	SB 1			
Volume Total	424	805	1658			
Volume Left	22	0	0			
Volume Right	0	0	560			
cSH	383	1700	1700			
Volume to Capacity	0.06	0.47	0.98			
Queue Length 95th (ft)	5	0	0			
Control Delay (s)	1.8	0.0	0.0			
Lane LOS	A					
Approach Delay (s)	0.6		0.0			
Approach LOS						
Intersection Summary						
Average Delay	0.3					
Intersection Capacity Utilization	88.0%			ICU Level of Service	E	
Analysis Period (min)	15					

Intersection						
Int Delay, s/veh	8.6					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	190	10	5	980	895	80
Future Vol, veh/h	190	10	5	980	895	80
Conflicting Peds, #/hr	0	0	5	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	150	-	-	-
Veh in Median Storage, #	2	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	207	11	5	1065	973	87

Major/Minor	Minor2	Major1	Major2			
Conflicting Flow All	2097	1022	1065	0	-	0
Stage 1	1022	-	-	-	-	-
Stage 2	1075	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	~ 57	287	654	-	-	-
Stage 1	347	-	-	-	-	-
Stage 2	328	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	~ 56	286	651	-	-	-
Mov Cap-2 Maneuver	227	-	-	-	-	-
Stage 1	342	-	-	-	-	-
Stage 2	326	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	92.1	0.1	0
HCM LOS	F		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	651	-	229	-	-
HCM Lane V/C Ratio	0.008	-	0.949	-	-
HCM Control Delay (s)	10.6	-	92.1	-	-
HCM Lane LOS	B	-	F	-	-
HCM 95th %tile Q(veh)	0	-	8.3	-	-

Notes
 -: Volume exceeds capacity \$: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

Intersection												
Int Delay, s/veh	10.3											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	105	5	10	5	5	65	10	815	15	70	825	5
Future Vol, veh/h	105	5	10	5	5	65	10	815	15	70	825	5
Conflicting Peds, #/hr	0	0	13	13	0	0	12	0	14	14	0	12
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None									
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	2	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	114	5	11	5	5	71	11	886	16	76	897	5

Major/Minor	Minor2		Minor1		Major1		Major2					
Conflicting Flow All	2018	2002	925	2003	1996	908	914	0	0	916	0	0
Stage 1	1064	1064	-	930	930	-	-	-	-	-	-	-
Stage 2	954	938	-	1073	1066	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	~ 43	60	326	44	60	334	746	-	-	745	-	-
Stage 1	270	300	-	321	346	-	-	-	-	-	-	-
Stage 2	311	343	-	267	299	-	-	-	-	-	-	-
Platoon blocked, %								-	-	-	-	-
Mov Cap-1 Maneuver	~ 25	45	318	33	45	330	737	-	-	735	-	-
Mov Cap-2 Maneuver	128	168	-	33	45	-	-	-	-	-	-	-
Stage 1	259	235	-	307	331	-	-	-	-	-	-	-
Stage 2	233	328	-	197	234	-	-	-	-	-	-	-

Approach	EB		WB		NB		SB	
HCM Control Delay, s	129.5		47.4		0.1		0.8	
HCM LOS	F		E					

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1WBLn1	SBL	SBT	SBR
Capacity (veh/h)	737	-	-	136	163	735	-
HCM Lane V/C Ratio	0.015	-	-	0.959	0.5	0.104	-
HCM Control Delay (s)	10	0	-	129.5	47.4	10.5	0
HCM Lane LOS	A	A	-	F	E	B	A
HCM 95th %tile Q(veh)	0	-	-	6.7	2.4	0.3	-

Notes
 -: Volume exceeds capacity \$: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

HCM Signalized Intersection Capacity Analysis

9: Kuhio Hwy & Kukui St

Kealia Mauka Homesites

11/05/2018



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	105	65	25	740	800	35
Future Volume (vph)	105	65	25	740	800	35
Ideal Flow (vphpl)	1900	1900	1900	1000	1200	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	
Frpb, ped/bikes	1.00	0.95	1.00	1.00	1.00	
Flpb, ped/bikes	0.98	1.00	1.00	1.00	1.00	
Frt	1.00	0.85	1.00	1.00	0.99	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1726	1507	1770	800	1169	
Flt Permitted	0.95	1.00	0.25	1.00	1.00	
Satd. Flow (perm)	1726	1507	472	980	1169	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	114	71	27	804	870	38
RTOR Reduction (vph)	0	64	0	0	1	0
Lane Group Flow (vph)	114	7	27	804	907	0
Confl. Peds. (#/hr)	6	7	2			2
Turn Type	Perm	Perm	pm+pt	NA	NA	
Protected Phases			5	2	6	
Permitted Phases	4	4	2			
Actuated Green, G (s)	16.9	16.9	155.1	155.1	146.3	
Effective Green, g (s)	16.9	16.9	155.1	155.1	146.3	
Actuated g/C Ratio	0.09	0.09	0.86	0.86	0.81	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	162	141	441	689	950	
v/s Ratio Prot			0.00	c1.00	0.78	
v/s Ratio Perm	c0.07	0.00	0.05			
v/c Ratio	0.70	0.05	0.06	1.17	0.96	
Uniform Delay, d1	79.1	74.2	5.2	12.5	14.1	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	13.0	0.1	0.1	90.3	20.2	
Delay (s)	92.1	74.4	5.2	102.8	34.3	
Level of Service	F	E	A	F	C	
Approach Delay (s)	85.3			99.6	34.3	
Approach LOS	F			F	C	

Intersection Summary

HCM 2000 Control Delay	67.4	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.15		
Actuated Cycle Length (s)	180.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	89.1%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Intersection				
Intersection Delay, s/veh	17.6			
Intersection LOS	C			
Approach	EB	WB	NB	SB
Entry Lanes	1	1	1	1
Conflicting Circle Lanes	1	1	1	1
Adj Approach Flow, veh/h	669	250	49	647
Demand Flow Rate, veh/h	682	255	50	659
Vehicles Circulating, veh/h	527	22	632	277
Vehicles Exiting, veh/h	409	660	577	0
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	28.3	4.3	5.8	12.6
Approach LOS	D	A	A	B
Lane	Left	Left	Left	Left
Designated Moves	TR	LT	LR	LTR
Assumed Moves	TR	LT	LR	LTR
RT Channelized				
Lane Util	1.000	1.000	1.000	1.000
Follow-Up Headway, s	2.609	2.609	2.609	2.609
Critical Headway, s	4.976	4.976	4.976	4.976
Entry Flow, veh/h	682	255	50	659
Cap Entry Lane, veh/h	806	1349	724	1040
Entry HV Adj Factor	0.981	0.979	0.980	0.982
Flow Entry, veh/h	669	250	49	647
Cap Entry, veh/h	791	1322	710	1021
V/C Ratio	0.846	0.189	0.069	0.633
Control Delay, s/veh	28.3	4.3	5.8	12.6
LOS	D	A	A	B
95th %tile Queue, veh	10	1	0	5

Intersection				
Intersection Delay, s/veh	3.2			
Intersection LOS	A			
Approach	EB	WB	NB	SB
Entry Lanes	1	1	1	1
Conflicting Circle Lanes	1	1	1	1
Adj Approach Flow, veh/h	0	71	54	71
Demand Flow Rate, veh/h	0	72	56	72
Vehicles Circulating, veh/h	144	28	0	72
Vehicles Exiting, veh/h	0	28	144	28
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	0.0	3.1	3.0	3.3
Approach LOS	-	A	A	A
Lane	Left	Left	Left	Left
Designated Moves	LTR	LTR	LTR	LTR
Assumed Moves	LTR	LTR	LTR	LTR
RT Channelized				
Lane Util	1.000	1.000	1.000	1.000
Follow-Up Headway, s	2.609	2.609	2.609	2.609
Critical Headway, s	4.976	4.976	4.976	4.976
Entry Flow, veh/h	0	72	56	72
Cap Entry Lane, veh/h	1191	1341	1380	1282
Entry HV Adj Factor	1.000	0.986	0.972	0.980
Flow Entry, veh/h	0	71	54	71
Cap Entry, veh/h	1191	1322	1342	1257
V/C Ratio	0.000	0.054	0.041	0.056
Control Delay, s/veh	3.0	3.1	3.0	3.3
LOS	A	A	A	A
95th %tile Queue, veh	0	0	0	0

Intersection				
Intersection Delay, s/veh	3.2			
Intersection LOS	A			
Approach	EB	WB	NB	SB
Entry Lanes	1	1	1	1
Conflicting Circle Lanes	1	1	1	1
Adj Approach Flow, veh/h	0	71	54	71
Demand Flow Rate, veh/h	0	72	56	72
Vehicles Circulating, veh/h	144	28	0	72
Vehicles Exiting, veh/h	0	28	144	28
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	0.0	3.1	3.0	3.3
Approach LOS	-	A	A	A
Lane	Left	Left	Left	Left
Designated Moves	LTR	LTR	LTR	LTR
Assumed Moves	LTR	LTR	LTR	LTR
RT Channelized				
Lane Util	1.000	1.000	1.000	1.000
Follow-Up Headway, s	2.609	2.609	2.609	2.609
Critical Headway, s	4.976	4.976	4.976	4.976
Entry Flow, veh/h	0	72	56	72
Cap Entry Lane, veh/h	1191	1341	1380	1282
Entry HV Adj Factor	1.000	0.986	0.972	0.980
Flow Entry, veh/h	0	71	54	71
Cap Entry, veh/h	1191	1322	1342	1257
V/C Ratio	0.000	0.054	0.041	0.056
Control Delay, s/veh	3.0	3.1	3.0	3.3
LOS	A	A	A	A
95th %tile Queue, veh	0	0	0	0



APPENDIX C

LEVEL OF SERVICE CALCULATIONS

- Future Year 2027 with Mitigation (Without Bypass) PM Peak
-
-

Intersection						
Int Delay, s/veh	0.5					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	W		T			T
Traffic Vol, veh/h	10	0	175	20	5	95
Future Vol, veh/h	10	0	175	20	5	95
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	11	0	190	22	5	103

Major/Minor	Minor1	Major1	Major2		
Conflicting Flow All	314	201	0	0	212
Stage 1	201	-	-	-	-
Stage 2	113	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12
Critical Hdwy Stg 1	5.42	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218
Pot Cap-1 Maneuver	679	840	-	-	1358
Stage 1	833	-	-	-	-
Stage 2	912	-	-	-	-
Platoon blocked, %			-	-	-
Mov Cap-1 Maneuver	676	840	-	-	1358
Mov Cap-2 Maneuver	676	-	-	-	-
Stage 1	830	-	-	-	-
Stage 2	912	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	10.4	0	0.4
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBRWBLn1	SBL	SBT
Capacity (veh/h)	-	-	676	1358
HCM Lane V/C Ratio	-	-	0.016	0.004
HCM Control Delay (s)	-	-	10.4	7.7
HCM Lane LOS	-	-	B	A
HCM 95th %tile Q(veh)	-	-	0	0

Intersection				
Intersection Delay, s/veh	11.7			
Intersection LOS	B			
Approach	EB	NB	SB	
Entry Lanes	1	1	1	
Conflicting Circle Lanes	1	1	1	
Adj Approach Flow, veh/h	179	914	902	
Demand Flow Rate, veh/h	183	931	920	
Vehicles Circulating, veh/h	926	50	94	
Vehicles Exiting, veh/h	72	1059	887	
Ped Vol Crossing Leg, #/h	0	0	0	
Ped Cap Adj	1.000	1.000	1.000	
Approach Delay, s/veh	10.9	11.5	12.0	
Approach LOS	B	B	B	
Lane	Left	Left	Left	Bypass
Designated Moves	LR	LT	T	R
Assumed Moves	LR	LT	T	R
RT Channelized				Yield
Lane Util	1.000	1.000	1.000	
Follow-Up Headway, s	2.500	2.500	2.500	
Critical Headway, s	4.800	4.800	4.800	16
Entry Flow, veh/h	183	931	904	1341
Cap Entry Lane, veh/h	578	1371	1313	0.980
Entry HV Adj Factor	0.978	0.981	0.980	16
Flow Entry, veh/h	179	913	886	1315
Cap Entry, veh/h	565	1344	1287	0.012
V/C Ratio	0.317	0.679	0.689	2.8
Control Delay, s/veh	10.9	11.5	12.2	A
LOS	B	B	B	0
95th %tile Queue, veh	1	6	6	

Intersection			
Intersection Delay, s/veh	18.9		
Intersection LOS	C		
Approach	EB	NB	SB
Entry Lanes	1	1	1
Conflicting Circle Lanes	1	1	1
Adj Approach Flow, veh/h	511	734	1005
Demand Flow Rate, veh/h	522	749	1025
Vehicles Circulating, veh/h	820	289	111
Vehicles Exiting, veh/h	316	1053	926
Ped Vol Crossing Leg, #/h	0	0	0
Ped Cap Adj	1.000	1.000	1.000
Approach Delay, s/veh	30.0	14.1	16.7
Approach LOS	D	B	C
Lane	Left	Left	Left
Designated Moves	LR	LT	TR
Assumed Moves	LR	LT	TR
RT Channelized			
Lane Util	1.000	1.000	1.000
Follow-Up Headway, s	2.500	2.500	2.500
Critical Headway, s	4.800	4.800	4.800
Entry Flow, veh/h	522	749	1025
Cap Entry Lane, veh/h	641	1083	1291
Entry HV Adj Factor	0.979	0.981	0.980
Flow Entry, veh/h	511	734	1005
Cap Entry, veh/h	628	1062	1265
V/C Ratio	0.814	0.692	0.794
Control Delay, s/veh	30.0	14.1	16.7
LOS	D	B	C
95th %tile Queue, veh	8	6	9

Intersection						
Int Delay, s/veh	5					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	0	170	245	895	990	15
Future Vol, veh/h	0	170	245	895	990	15
Conflicting Peds, #/hr	8	0	8	0	0	8
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	0	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	185	266	973	1076	16

Major/Minor	Minor2	Major1	Major2			
Conflicting Flow All	2605	1092	1100	0	-	0
Stage 1	1092	-	-	-	-	-
Stage 2	1513	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	27	261	635	-	-	-
Stage 1	322	-	-	-	-	-
Stage 2	201	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	15	259	630	-	-	-
Mov Cap-2 Maneuver	15	-	-	-	-	-
Stage 1	185	-	-	-	-	-
Stage 2	199	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	47.3	3.2	0
HCM LOS	E		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	630	-	259	-	-
HCM Lane V/C Ratio	0.423	-	0.713	-	-
HCM Control Delay (s)	14.8	-	47.3	-	-
HCM Lane LOS	B	-	E	-	-
HCM 95th %tile Q(veh)	2.1	-	4.9	-	-

Intersection						
Int Delay, s/veh	7.5					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	T			T		T
Traffic Vol, veh/h	5	95	100	1165	1175	15
Future Vol, veh/h	5	95	100	1165	1175	15
Conflicting Peds, #/hr	0	0	8	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	5	103	109	1266	1277	16

Major/Minor	Minor2	Major1	Major2			
Conflicting Flow All	2144	1293	1301	0	-	0
Stage 1	1293	-	-	-	-	-
Stage 2	851	-	-	-	-	-
Critical Hdwy	6.63	6.23	4.13	-	-	-
Critical Hdwy Stg 1	5.43	-	-	-	-	-
Critical Hdwy Stg 2	5.83	-	-	-	-	-
Follow-up Hdwy	3.519	3.319	2.219	-	-	-
Pot Cap-1 Maneuver	47	198	530	-	-	-
Stage 1	256	-	-	-	-	-
Stage 2	380	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	14	196	526	-	-	-
Mov Cap-2 Maneuver	14	-	-	-	-	-
Stage 1	77	-	-	-	-	-
Stage 2	377	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	129	4.9	0
HCM LOS	F		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	526	-	119	-	-
HCM Lane V/C Ratio	0.207	-	0.913	-	-
HCM Control Delay (s)	13.6	4.1	129	-	-
HCM Lane LOS	B	A	F	-	-
HCM 95th %tile Q(veh)	0.8	-	5.8	-	-

HCM Unsignalized Intersection Capacity Analysis
6: Kuhio Hwy & Cane Haul Rd

Kealia Mauka Homesites

11/05/2018



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations				↕↕	↕	
Traffic Volume (veh/h)	0	0	15	1275	895	375
Future Volume (Veh/h)	0	0	15	1275	895	375
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)	0	0	16	1386	973	408
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	1902	1177	1381			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1902	1177	1381			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	100	100	97			
cM capacity (veh/h)	59	184	492			
Direction, Lane #	NB 1	NB 2	SB 1			
Volume Total	478	924	1381			
Volume Left	16	0	0			
Volume Right	0	0	408			
cSH	492	1700	1700			
Volume to Capacity	0.03	0.54	0.81			
Queue Length 95th (ft)	3	0	0			
Control Delay (s)	1.0	0.0	0.0			
Lane LOS	A					
Approach Delay (s)	0.3		0.0			
Approach LOS						
Intersection Summary						
Average Delay			0.2			
Intersection Capacity Utilization			73.3%	ICU Level of Service		D
Analysis Period (min)			15			

Intersection						
Int Delay, s/veh	8.3					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	170	10	20	1115	735	175
Future Vol, veh/h	170	10	20	1115	735	175
Conflicting Peds, #/hr	0	0	8	0	0	8
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	150	-	-	-
Veh in Median Storage, #	2	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	185	11	22	1212	799	190

Major/Minor	Minor2	Major1	Major2			
Conflicting Flow All	2158	902	997	0	-	0
Stage 1	902	-	-	-	-	-
Stage 2	1256	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	~ 52	336	694	-	-	-
Stage 1	396	-	-	-	-	-
Stage 2	268	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	~ 50	333	689	-	-	-
Mov Cap-2 Maneuver	199	-	-	-	-	-
Stage 1	380	-	-	-	-	-
Stage 2	266	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	101.2	0.2	0
HCM LOS	F		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	689	-	204	-	-
HCM Lane V/C Ratio	0.032	-	0.959	-	-
HCM Control Delay (s)	10.4	-	101.2	-	-
HCM Lane LOS	B	-	F	-	-
HCM 95th %tile Q(veh)	0.1	-	8.1	-	-

Notes
 -: Volume exceeds capacity \$: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

Intersection												
Int Delay, s/veh	11.5											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	45	5	25	5	5	110	20	985	15	40	705	15
Future Vol, veh/h	45	5	25	5	5	110	20	985	15	40	705	15
Conflicting Peds, #/hr	0	0	34	34	0	0	30	0	35	35	0	30
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None									
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	2	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	49	5	27	5	5	120	22	1071	16	43	766	16

Major/Minor	Minor2		Minor1		Major1		Major2					
Conflicting Flow All	2076	2056	838	2068	2056	1114	812	0	0	1122	0	0
Stage 1	890	890	-	1158	1158	-	-	-	-	-	-	-
Stage 2	1186	1166	-	910	898	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	~ 39	55	366	40	55	253	814	-	-	623	-	-
Stage 1	337	361	-	239	270	-	-	-	-	-	-	-
Stage 2	230	268	-	329	358	-	-	-	-	-	-	-
Platoon blocked, %								-	-	-	-	-
Mov Cap-1 Maneuver	~ 15	42	344	29	42	245	791	-	-	602	-	-
Mov Cap-2 Maneuver	60	161	-	29	42	-	-	-	-	-	-	-
Stage 1	304	306	-	215	242	-	-	-	-	-	-	-
Stage 2	107	241	-	251	304	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	161	83.2	0.2	0.6
HCM LOS	F	F		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1WBLn1	SBL	SBT	SBR
Capacity (veh/h)	791	-	-	88	162	602	-
HCM Lane V/C Ratio	0.027	-	-	0.926	0.805	0.072	-
HCM Control Delay (s)	9.7	0	-	161	83.2	11.4	0
HCM Lane LOS	A	A	-	F	F	B	A
HCM 95th %tile Q(veh)	0.1	-	-	5.1	5.3	0.2	-

Notes
 -: Volume exceeds capacity \$: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

HCM Signalized Intersection Capacity Analysis
 9: Kuhio Hwy & Kukui St

Kealia Mauka Homesites
 11/05/2018



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	235	65	35	800	685	55
Future Volume (vph)	235	65	35	800	685	55
Ideal Flow (vphpl)	1900	1900	1900	1000	1200	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	
Frpb, ped/bikes	1.00	0.80	1.00	1.00	0.99	
Flpb, ped/bikes	0.86	1.00	1.00	1.00	1.00	
Frt	1.00	0.85	1.00	1.00	0.99	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1528	1262	1770	800	1150	
Flt Permitted	0.95	1.00	0.26	1.00	1.00	
Satd. Flow (perm)	1528	1262	485	980	1150	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	255	71	38	870	745	60
RTOR Reduction (vph)	0	55	0	0	1	0
Lane Group Flow (vph)	255	16	38	870	804	0
Confl. Peds. (#/hr)	30	41	46			46
Turn Type	Perm	Perm	pm+pt	NA	NA	
Protected Phases			5	2	6	
Permitted Phases	4	4	2			
Actuated Green, G (s)	35.1	35.1	156.9	156.9	147.6	
Effective Green, g (s)	35.1	35.1	156.9	156.9	147.6	
Actuated g/C Ratio	0.18	0.18	0.78	0.78	0.74	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	268	221	414	627	848	
v/s Ratio Prot			0.00	c1.09	0.70	
v/s Ratio Perm	c0.17	0.01	0.07			
v/c Ratio	0.95	0.07	0.09	1.39	0.95	
Uniform Delay, d1	81.6	68.8	9.5	21.5	22.8	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	41.7	0.1	0.1	184.1	20.5	
Delay (s)	123.3	69.0	9.6	205.7	43.4	
Level of Service	F	E	A	F	D	
Approach Delay (s)	111.4			197.5	43.4	
Approach LOS	F			F	D	

Intersection Summary

HCM 2000 Control Delay	122.9	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.33		
Actuated Cycle Length (s)	200.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	103.6%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

Intersection				
Intersection Delay, s/veh	11.5			
Intersection LOS	B			
Approach	EB	WB	NB	SB
Entry Lanes	1	1	1	1
Conflicting Circle Lanes	1	1	1	1
Adj Approach Flow, veh/h	451	511	304	501
Demand Flow Rate, veh/h	460	522	311	511
Vehicles Circulating, veh/h	434	78	500	600
Vehicles Exiting, veh/h	677	733	394	0
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	11.1	6.9	9.0	18.2
Approach LOS	B	A	A	C
Lane	Left	Left	Left	Left
Designated Moves	TR	LT	LR	LTR
Assumed Moves	TR	LT	LR	LTR
RT Channelized				
Lane Util	1.000	1.000	1.000	1.000
Follow-Up Headway, s	2.609	2.609	2.609	2.609
Critical Headway, s	4.976	4.976	4.976	4.976
Entry Flow, veh/h	460	522	311	511
Cap Entry Lane, veh/h	886	1274	829	748
Entry HV Adj Factor	0.980	0.980	0.977	0.980
Flow Entry, veh/h	451	511	304	501
Cap Entry, veh/h	869	1248	810	733
V/C Ratio	0.519	0.410	0.375	0.683
Control Delay, s/veh	11.1	6.9	9.0	18.2
LOS	B	A	A	C
95th %tile Queue, veh	3	2	2	5

Intersection				
Intersection Delay, s/veh	3.5			
Intersection LOS	A			
Approach	EB	WB	NB	SB
Entry Lanes	1	1	1	1
Conflicting Circle Lanes	1	1	1	1
Adj Approach Flow, veh/h	0	49	164	49
Demand Flow Rate, veh/h	0	50	168	50
Vehicles Circulating, veh/h	100	84	0	50
Vehicles Exiting, veh/h	0	84	100	84
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	0.0	3.2	3.6	3.1
Approach LOS	-	A	A	A
Lane	Left	Left	Left	Left
Designated Moves	LTR	LTR	LTR	LTR
Assumed Moves	LTR	LTR	LTR	LTR
RT Channelized				
Lane Util	1.000	1.000	1.000	1.000
Follow-Up Headway, s	2.609	2.609	2.609	2.609
Critical Headway, s	4.976	4.976	4.976	4.976
Entry Flow, veh/h	0	50	168	50
Cap Entry Lane, veh/h	1246	1267	1380	1311
Entry HV Adj Factor	1.000	0.980	0.978	0.980
Flow Entry, veh/h	0	49	164	49
Cap Entry, veh/h	1246	1241	1350	1286
V/C Ratio	0.000	0.039	0.122	0.038
Control Delay, s/veh	2.9	3.2	3.6	3.1
LOS	A	A	A	A
95th %tile Queue, veh	0	0	0	0

Intersection				
Intersection Delay, s/veh	3.5			
Intersection LOS	A			
Approach	EB	WB	NB	SB
Entry Lanes	1	1	1	1
Conflicting Circle Lanes	1	1	1	1
Adj Approach Flow, veh/h	0	49	164	49
Demand Flow Rate, veh/h	0	50	168	50
Vehicles Circulating, veh/h	100	84	0	50
Vehicles Exiting, veh/h	0	84	100	84
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	0.0	3.2	3.6	3.1
Approach LOS	-	A	A	A
Lane	Left	Left	Left	Left
Designated Moves	LTR	LTR	LTR	LTR
Assumed Moves	LTR	LTR	LTR	LTR
RT Channelized				
Lane Util	1.000	1.000	1.000	1.000
Follow-Up Headway, s	2.609	2.609	2.609	2.609
Critical Headway, s	4.976	4.976	4.976	4.976
Entry Flow, veh/h	0	50	168	50
Cap Entry Lane, veh/h	1246	1267	1380	1311
Entry HV Adj Factor	1.000	0.980	0.978	0.980
Flow Entry, veh/h	0	49	164	49
Cap Entry, veh/h	1246	1241	1350	1286
V/C Ratio	0.000	0.039	0.122	0.038
Control Delay, s/veh	2.9	3.2	3.6	3.1
LOS	A	A	A	A
95th %tile Queue, veh	0	0	0	0



APPENDIX C

LEVEL OF SERVICE CALCULATIONS

- Future Year 2027 with Mitigation (With Bypass) AM Peak
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-

Intersection						
Int Delay, s/veh	1.2					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	20	5	50	15	5	140
Future Vol, veh/h	20	5	50	15	5	140
Conflicting Peds, #/hr	1	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	22	5	54	16	5	152

Major/Minor	Minor1	Major1	Major2			
Conflicting Flow All	225	62	0	0	70	0
Stage 1	62	-	-	-	-	-
Stage 2	163	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	763	1003	-	-	1531	-
Stage 1	961	-	-	-	-	-
Stage 2	866	-	-	-	-	-
Platoon blocked, %			-	-	-	-
Mov Cap-1 Maneuver	759	1003	-	-	1531	-
Mov Cap-2 Maneuver	759	-	-	-	-	-
Stage 1	957	-	-	-	-	-
Stage 2	865	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	9.7	0	0.3
HCM LOS	A		

Minor Lane/Major Mvmt	NBT	NBRWBLn1	SBL	SBT
Capacity (veh/h)	-	-	798	1531
HCM Lane V/C Ratio	-	-	0.034	0.004
HCM Control Delay (s)	-	-	9.7	7.4
HCM Lane LOS	-	-	A	A
HCM 95th %tile Q(veh)	-	-	0.1	0

Intersection				
Intersection Delay, s/veh	11.7			
Intersection LOS	B			
Approach	EB	NB	SB	
Entry Lanes	1	1	1	
Conflicting Circle Lanes	1	1	1	
Adj Approach Flow, veh/h	179	914	902	
Demand Flow Rate, veh/h	183	931	920	
Vehicles Circulating, veh/h	926	50	94	
Vehicles Exiting, veh/h	72	1059	887	
Ped Vol Crossing Leg, #/h	0	0	0	
Ped Cap Adj	1.000	1.000	1.000	
Approach Delay, s/veh	10.9	11.5	12.0	
Approach LOS	B	B	B	
Lane	Left	Left	Left	Bypass
Designated Moves	LR	LT	T	R
Assumed Moves	LR	LT	T	R
RT Channelized				Yield
Lane Util	1.000	1.000	1.000	
Follow-Up Headway, s	2.500	2.500	2.500	
Critical Headway, s	4.800	4.800	4.800	16
Entry Flow, veh/h	183	931	904	1341
Cap Entry Lane, veh/h	578	1371	1313	0.980
Entry HV Adj Factor	0.978	0.981	0.980	16
Flow Entry, veh/h	179	913	886	1315
Cap Entry, veh/h	565	1344	1287	0.012
V/C Ratio	0.317	0.679	0.689	2.8
Control Delay, s/veh	10.9	11.5	12.2	A
LOS	B	B	B	0
95th %tile Queue, veh	1	6	6	

Intersection			
Intersection Delay, s/veh	17.8		
Intersection LOS	C		
Approach	EB	NB	SB
Entry Lanes	1	1	1
Conflicting Circle Lanes	1	1	1
Adj Approach Flow, veh/h	479	696	1005
Demand Flow Rate, veh/h	488	710	1025
Vehicles Circulating, veh/h	820	327	111
Vehicles Exiting, veh/h	316	981	926
Ped Vol Crossing Leg, #/h	0	0	0
Ped Cap Adj	1.000	1.000	1.000
Approach Delay, s/veh	25.4	14.1	16.7
Approach LOS	D	B	C
Lane	Left	Left	Left
Designated Moves	LR	LT	TR
Assumed Moves	LR	LT	TR
RT Channelized			
Lane Util	1.000	1.000	1.000
Follow-Up Headway, s	2.500	2.500	2.500
Critical Headway, s	4.800	4.800	4.800
Entry Flow, veh/h	488	710	1025
Cap Entry Lane, veh/h	641	1043	1291
Entry HV Adj Factor	0.982	0.981	0.980
Flow Entry, veh/h	479	696	1005
Cap Entry, veh/h	630	1023	1265
V/C Ratio	0.761	0.681	0.794
Control Delay, s/veh	25.4	14.1	16.7
LOS	D	B	C
95th %tile Queue, veh	7	6	9

Intersection						
Int Delay, s/veh	11.4					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	5	220	280	575	835	30
Future Vol, veh/h	5	220	280	575	835	30
Conflicting Peds, #/hr	9	0	8	0	0	8
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	100	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	5	239	304	625	908	33

Major/Minor	Minor2	Major1	Major2			
Conflicting Flow All	2175	933	949	0	-	0
Stage 1	933	-	-	-	-	-
Stage 2	1242	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	51	323	724	-	-	-
Stage 1	383	-	-	-	-	-
Stage 2	272	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	29	321	718	-	-	-
Mov Cap-2 Maneuver	29	-	-	-	-	-
Stage 1	219	-	-	-	-	-
Stage 2	270	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	81.2	4.5	0
HCM LOS	F		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	718	-	262	-	-
HCM Lane V/C Ratio	0.424	-	0.933	-	-
HCM Control Delay (s)	13.7	-	81.2	-	-
HCM Lane LOS	B	-	F	-	-
HCM 95th %tile Q(veh)	2.1	-	8.5	-	-

Intersection						
Int Delay, s/veh	20					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↕	↕		↕	
Traffic Vol, veh/h	130	80	395	35	110	280
Future Vol, veh/h	130	80	395	35	110	280
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	141	87	429	38	120	304

Major/Minor	Major1	Major2	Minor2		
Conflicting Flow All	467	0	-	0	817 448
Stage 1	-	-	-	-	448 -
Stage 2	-	-	-	-	369 -
Critical Hdwy	4.12	-	-	-	6.42 6.22
Critical Hdwy Stg 1	-	-	-	-	5.42 -
Critical Hdwy Stg 2	-	-	-	-	5.42 -
Follow-up Hdwy	2.218	-	-	-	3.518 3.318
Pot Cap-1 Maneuver	1094	-	-	-	346 611
Stage 1	-	-	-	-	644 -
Stage 2	-	-	-	-	699 -
Platoon blocked, %		-	-	-	
Mov Cap-1 Maneuver	1094	-	-	-	299 611
Mov Cap-2 Maneuver	-	-	-	-	299 -
Stage 1	-	-	-	-	557 -
Stage 2	-	-	-	-	699 -

Approach	EB	WB	SB
HCM Control Delay, s	5.4	0	49.8
HCM LOS			E

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1094	-	-	-	472
HCM Lane V/C Ratio	0.129	-	-	-	0.898
HCM Control Delay (s)	8.8	0	-	-	49.8
HCM Lane LOS	A	A	-	-	E
HCM 95th %tile Q(veh)	0.4	-	-	-	10

Intersection

Int Delay, s/veh 6.6

Movement EBL EBR NBL NBT SBT SBR

Lane Configurations						
Traffic Vol, veh/h	85	105	45	885	780	375
Future Vol, veh/h	85	105	45	885	780	375
Conflicting Peds, #/hr	9	0	4	0	0	4
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	2	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	92	114	49	962	848	408

Major/Minor Minor2 Major1 Major2

Conflicting Flow All	2125	1056	1260	0	-	0
Stage 1	1056	-	-	-	-	-
Stage 2	1069	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	~ 55	274	552	-	-	-
Stage 1	335	-	-	-	-	-
Stage 2	330	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	~ 50	273	550	-	-	-
Mov Cap-2 Maneuver	200	-	-	-	-	-
Stage 1	304	-	-	-	-	-
Stage 2	329	-	-	-	-	-

Approach EB NB SB

HCM Control Delay, s 75.5 0.6 0
HCM LOS F

Minor Lane/Major Mvmt NBL NBT EBLn1 SBT SBR

Capacity (veh/h)	550	-	235	-	-
HCM Lane V/C Ratio	0.089	-	0.879	-	-
HCM Control Delay (s)	12.2	-	75.5	-	-
HCM Lane LOS	B	-	F	-	-
HCM 95th %tile Q(veh)	0.3	-	7.2	-	-

Notes

~: Volume exceeds capacity \$: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

Intersection

Int Delay, s/veh 3.9

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	Y		Y	↑	↑	
Traffic Vol, veh/h	165	10	5	800	765	80
Future Vol, veh/h	165	10	5	800	765	80
Conflicting Peds, #/hr	0	0	5	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	150	-	-	-
Veh in Median Storage, #	2	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	179	11	5	870	832	87

Major/Minor

	Minor2	Major1	Major2			
Conflicting Flow All	1761	881	924	0	-	0
Stage 1	881	-	-	-	-	-
Stage 2	880	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	~ 93	346	739	-	-	-
Stage 1	405	-	-	-	-	-
Stage 2	406	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	~ 91	344	735	-	-	-
Mov Cap-2 Maneuver	282	-	-	-	-	-
Stage 1	400	-	-	-	-	-
Stage 2	404	-	-	-	-	-

Approach

	EB	NB	SB
HCM Control Delay, s	39.7	0.1	0
HCM LOS	E		

Minor Lane/Major Mvmt

	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	735	-	285	-	-
HCM Lane V/C Ratio	0.007	-	0.667	-	-
HCM Control Delay (s)	9.9	-	39.7	-	-
HCM Lane LOS	A	-	E	-	-
HCM 95th %tile Q(veh)	0	-	4.4	-	-

Notes

~: Volume exceeds capacity \$: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

Intersection												
Int Delay, s/veh	2.5											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	5	5	10	5	5	55	10	735	5	70	700	5
Future Vol, veh/h	5	5	10	5	5	55	10	735	5	70	700	5
Conflicting Peds, #/hr	0	0	13	13	0	0	12	0	14	14	0	12
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None									
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	5	5	11	5	5	60	11	799	5	76	761	5

Major/Minor	Minor2		Minor1		Major1		Major2					
Conflicting Flow All	1784	1768	789	1775	1768	816	778	0	0	818	0	0
Stage 1	928	928	-	838	838	-	-	-	-	-	-	-
Stage 2	856	840	-	937	930	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	63	84	391	64	84	377	839	-	-	810	-	-
Stage 1	321	347	-	361	382	-	-	-	-	-	-	-
Stage 2	352	381	-	318	346	-	-	-	-	-	-	-
Platoon blocked, %								-	-	-	-	-
Mov Cap-1 Maneuver	42	67	382	49	67	372	829	-	-	799	-	-
Mov Cap-2 Maneuver	42	67	-	49	67	-	-	-	-	-	-	-
Stage 1	310	286	-	348	368	-	-	-	-	-	-	-
Stage 2	284	367	-	250	285	-	-	-	-	-	-	-

Approach	EB		WB		NB		SB	
HCM Control Delay, s	56.6		32.5		0.1		0.9	
HCM LOS	F		D					

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1WBLn1	SBL	SBT	SBR
Capacity (veh/h)	829	-	-	91	200	799	-
HCM Lane V/C Ratio	0.013	-	-	0.239	0.353	0.095	-
HCM Control Delay (s)	9.4	0	-	56.6	32.5	10	0
HCM Lane LOS	A	A	-	F	D	A	A
HCM 95th %tile Q(veh)	0	-	-	0.9	1.5	0.3	-

HCM Signalized Intersection Capacity Analysis

9: Kuhio Hwy & Kukui St

Kealia Mauka Homesites

11/05/2018



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕	↗			↗	↖	↖			↕	
Traffic Volume (vph)	40	5	60	0	0	15	25	705	20	0	670	35
Future Volume (vph)	40	5	60	0	0	15	25	705	20	0	670	35
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1200	1900	1900	1200	1900
Total Lost time (s)		4.0	4.0			4.0	4.0	4.0			4.0	
Lane Util. Factor		1.00	1.00			1.00	1.00	1.00			1.00	
Frbp, ped/bikes		1.00	0.95			0.94	1.00	1.00			1.00	
Flpb, ped/bikes		0.97	1.00			1.00	1.00	1.00			1.00	
Frt		1.00	0.85			0.86	1.00	1.00			0.99	
Flt Protected		0.96	1.00			1.00	0.95	1.00			1.00	
Satd. Flow (prot)		1737	1500			1509	1769	1169			1167	
Flt Permitted		0.96	1.00			1.00	0.33	1.00			1.00	
Satd. Flow (perm)		1737	1500			1509	610	1169			1167	
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)	43	5	65	0	0	16	27	766	22	0	728	38
RTOR Reduction (vph)	0	0	61	0	0	15	0	0	0	0	1	0
Lane Group Flow (vph)	0	48	4	0	0	1	27	788	0	0	765	0
Confl. Peds. (#/hr)	6		7			6	2		13	13		2
Turn Type	Perm	NA	Perm			Perm	pm+pt	NA			NA	
Protected Phases		4					5	2				6
Permitted Phases	4		4			8	2		6			
Actuated Green, G (s)		14.3	14.3			14.3	187.7	187.7			178.9	
Effective Green, g (s)		14.3	14.3			14.3	187.7	187.7			178.9	
Actuated g/C Ratio		0.07	0.07			0.07	0.89	0.89			0.85	
Clearance Time (s)		4.0	4.0			4.0	4.0	4.0			4.0	
Vehicle Extension (s)		3.0	3.0			3.0	3.0	3.0			3.0	
Lane Grp Cap (vph)		118	102			102	571	1044			994	
v/s Ratio Prot							0.00	c0.67			c0.66	
v/s Ratio Perm		0.03	0.00			0.00	0.04					
v/c Ratio		0.41	0.04			0.01	0.05	0.75			0.77	
Uniform Delay, d1		93.8	91.5			91.3	2.5	3.6			6.7	
Progression Factor		1.00	1.00			1.00	1.00	1.00			1.00	
Incremental Delay, d2		2.3	0.2			0.0	0.0	5.1			5.7	
Delay (s)		96.1	91.6			91.3	2.6	8.7			12.4	
Level of Service		F	F			F	A	A			B	
Approach Delay (s)		93.5		91.3				8.5			12.4	
Approach LOS		F		F				A			B	

Intersection Summary

HCM 2000 Control Delay	16.7	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.75		
Actuated Cycle Length (s)	210.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	82.0%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Intersection				
Intersection Delay, s/veh 27.2				
Intersection LOS D				
Approach	EB	WB	NB	SB
Entry Lanes	1	1	1	1
Conflicting Circle Lanes	1	1	1	1
Adj Approach Flow, veh/h	685	255	49	793
Demand Flow Rate, veh/h	698	260	49	809
Vehicles Circulating, veh/h	621	243	670	277
Vehicles Exiting, veh/h	465	476	649	226
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	46.7	5.7	5.9	18.5
Approach LOS	E	A	A	C
Lane	Left	Left	Left	Left
Designated Moves	LTR	LTR	LTR	LTR
Assumed Moves	LTR	LTR	LTR	LTR
RT Channelized				
Lane Util	1.000	1.000	1.000	1.000
Follow-Up Headway, s	2.609	2.609	2.609	2.609
Critical Headway, s	4.976	4.976	4.976	4.976
Entry Flow, veh/h	698	260	49	809
Cap Entry Lane, veh/h	732	1077	697	1040
Entry HV Adj Factor	0.981	0.980	0.994	0.981
Flow Entry, veh/h	685	255	49	793
Cap Entry, veh/h	719	1055	692	1020
V/C Ratio	0.953	0.241	0.070	0.778
Control Delay, s/veh	46.7	5.7	5.9	18.5
LOS	E	A	A	C
95th %tile Queue, veh	14	1	0	8

Intersection				
Intersection Delay, s/veh	3.2			
Intersection LOS	A			
Approach	EB	WB	NB	SB
Entry Lanes	1	1	1	1
Conflicting Circle Lanes	1	1	1	1
Adj Approach Flow, veh/h	15	81	59	81
Demand Flow Rate, veh/h	15	82	61	82
Vehicles Circulating, veh/h	149	38	15	82
Vehicles Exiting, veh/h	15	38	149	38
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	3.2	3.2	3.1	3.4
Approach LOS	A	A	A	A
Lane	Left	Left	Left	Left
Designated Moves	LTR	LTR	LTR	LTR
Assumed Moves	LTR	LTR	LTR	LTR
RT Channelized				
Lane Util	1.000	1.000	1.000	1.000
Follow-Up Headway, s	2.609	2.609	2.609	2.609
Critical Headway, s	4.976	4.976	4.976	4.976
Entry Flow, veh/h	15	82	61	82
Cap Entry Lane, veh/h	1185	1327	1359	1269
Entry HV Adj Factor	0.993	0.987	0.975	0.983
Flow Entry, veh/h	15	81	59	81
Cap Entry, veh/h	1178	1310	1324	1247
V/C Ratio	0.013	0.062	0.045	0.065
Control Delay, s/veh	3.2	3.2	3.1	3.4
LOS	A	A	A	A
95th %tile Queue, veh	0	0	0	0

Intersection				
Intersection Delay, s/veh	3.2			
Intersection LOS	A			
Approach	EB	WB	NB	SB
Entry Lanes	1	1	1	1
Conflicting Circle Lanes	1	1	1	1
Adj Approach Flow, veh/h	15	81	59	81
Demand Flow Rate, veh/h	15	82	61	82
Vehicles Circulating, veh/h	149	38	15	82
Vehicles Exiting, veh/h	15	38	149	38
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	3.2	3.2	3.1	3.4
Approach LOS	A	A	A	A
Lane	Left	Left	Left	Left
Designated Moves	LTR	LTR	LTR	LTR
Assumed Moves	LTR	LTR	LTR	LTR
RT Channelized				
Lane Util	1.000	1.000	1.000	1.000
Follow-Up Headway, s	2.609	2.609	2.609	2.609
Critical Headway, s	4.976	4.976	4.976	4.976
Entry Flow, veh/h	15	82	61	82
Cap Entry Lane, veh/h	1185	1327	1359	1269
Entry HV Adj Factor	0.993	0.987	0.975	0.983
Flow Entry, veh/h	15	81	59	81
Cap Entry, veh/h	1178	1310	1324	1247
V/C Ratio	0.013	0.062	0.045	0.065
Control Delay, s/veh	3.2	3.2	3.1	3.4
LOS	A	A	A	A
95th %tile Queue, veh	0	0	0	0



APPENDIX C

LEVEL OF SERVICE CALCULATIONS

- Future Year 2027 with Mitigation (With Bypass) PM Peak
-
-

Intersection						
Int Delay, s/veh	0.5					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	W		T			T
Traffic Vol, veh/h	10	0	175	20	5	95
Future Vol, veh/h	10	0	175	20	5	95
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	11	0	190	22	5	103

Major/Minor	Minor1	Major1	Major2			
Conflicting Flow All	314	201	0	0	212	0
Stage 1	201	-	-	-	-	-
Stage 2	113	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	679	840	-	-	1358	-
Stage 1	833	-	-	-	-	-
Stage 2	912	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	676	840	-	-	1358	-
Mov Cap-2 Maneuver	676	-	-	-	-	-
Stage 1	830	-	-	-	-	-
Stage 2	912	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	10.4	0	0.4
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBRWBLn1	SBL	SBT
Capacity (veh/h)	-	-	676	1358
HCM Lane V/C Ratio	-	-	0.016	0.004
HCM Control Delay (s)	-	-	10.4	7.7
HCM Lane LOS	-	-	B	A
HCM 95th %tile Q(veh)	-	-	0	0

Intersection				
Intersection Delay, s/veh	11.7			
Intersection LOS	B			
Approach	EB	NB	SB	
Entry Lanes	1	1	1	
Conflicting Circle Lanes	1	1	1	
Adj Approach Flow, veh/h	179	914	902	
Demand Flow Rate, veh/h	183	931	920	
Vehicles Circulating, veh/h	926	50	94	
Vehicles Exiting, veh/h	72	1059	887	
Ped Vol Crossing Leg, #/h	0	0	0	
Ped Cap Adj	1.000	1.000	1.000	
Approach Delay, s/veh	10.9	11.5	12.0	
Approach LOS	B	B	B	
Lane	Left	Left	Left	Bypass
Designated Moves	LR	LT	T	R
Assumed Moves	LR	LT	T	R
RT Channelized				Yield
Lane Util	1.000	1.000	1.000	
Follow-Up Headway, s	2.500	2.500	2.500	
Critical Headway, s	4.800	4.800	4.800	16
Entry Flow, veh/h	183	931	904	1341
Cap Entry Lane, veh/h	578	1371	1313	0.980
Entry HV Adj Factor	0.978	0.981	0.980	16
Flow Entry, veh/h	179	913	886	1315
Cap Entry, veh/h	565	1344	1287	0.012
V/C Ratio	0.317	0.679	0.689	2.8
Control Delay, s/veh	10.9	11.5	12.2	A
LOS	B	B	B	0
95th %tile Queue, veh	1	6	6	

Intersection			
Intersection Delay, s/veh	17.8		
Intersection LOS	C		
Approach	EB	NB	SB
Entry Lanes	1	1	1
Conflicting Circle Lanes	1	1	1
Adj Approach Flow, veh/h	479	696	1005
Demand Flow Rate, veh/h	488	710	1025
Vehicles Circulating, veh/h	820	327	111
Vehicles Exiting, veh/h	316	981	926
Ped Vol Crossing Leg, #/h	0	0	0
Ped Cap Adj	1.000	1.000	1.000
Approach Delay, s/veh	25.4	14.1	16.7
Approach LOS	D	B	C
Lane	Left	Left	Left
Designated Moves	LR	LT	TR
Assumed Moves	LR	LT	TR
RT Channelized			
Lane Util	1.000	1.000	1.000
Follow-Up Headway, s	2.500	2.500	2.500
Critical Headway, s	4.800	4.800	4.800
Entry Flow, veh/h	488	710	1025
Cap Entry Lane, veh/h	641	1043	1291
Entry HV Adj Factor	0.982	0.981	0.980
Flow Entry, veh/h	479	696	1005
Cap Entry, veh/h	630	1023	1265
V/C Ratio	0.761	0.681	0.794
Control Delay, s/veh	25.4	14.1	16.7
LOS	D	B	C
95th %tile Queue, veh	7	6	9

Intersection						
Int Delay, s/veh	3.5					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↔		↔	↑	↑	
Traffic Vol, veh/h	0	145	210	850	925	15
Future Vol, veh/h	0	145	210	850	925	15
Conflicting Peds, #/hr	8	0	8	0	0	8
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	100	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	158	228	924	1005	16

Major/Minor	Minor2	Major1	Major2			
Conflicting Flow All	2409	1021	1029	0	-	0
Stage 1	1021	-	-	-	-	-
Stage 2	1388	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	36	287	675	-	-	-
Stage 1	348	-	-	-	-	-
Stage 2	231	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	23	285	670	-	-	-
Mov Cap-2 Maneuver	23	-	-	-	-	-
Stage 1	228	-	-	-	-	-
Stage 2	229	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	32.2	2.6	0
HCM LOS	D		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	670	-	285	-	-
HCM Lane V/C Ratio	0.341	-	0.553	-	-
HCM Control Delay (s)	13.1	-	32.2	-	-
HCM Lane LOS	B	-	D	-	-
HCM 95th %tile Q(veh)	1.5	-	3.1	-	-

Intersection						
Int Delay, s/veh	5.5					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↶	↷		↶	↷
Traffic Vol, veh/h	150	100	350	50	50	135
Future Vol, veh/h	150	100	350	50	50	135
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	163	109	380	54	54	147

Major/Minor	Major1	Major2	Minor2		
Conflicting Flow All	434	0	-	0	842 407
Stage 1	-	-	-	-	407 -
Stage 2	-	-	-	-	435 -
Critical Hdwy	4.12	-	-	-	6.42 6.22
Critical Hdwy Stg 1	-	-	-	-	5.42 -
Critical Hdwy Stg 2	-	-	-	-	5.42 -
Follow-up Hdwy	2.218	-	-	-	3.518 3.318
Pot Cap-1 Maneuver	1126	-	-	-	334 644
Stage 1	-	-	-	-	672 -
Stage 2	-	-	-	-	653 -
Platoon blocked, %		-	-	-	
Mov Cap-1 Maneuver	1126	-	-	-	283 644
Mov Cap-2 Maneuver	-	-	-	-	283 -
Stage 1	-	-	-	-	569 -
Stage 2	-	-	-	-	653 -

Approach	EB	WB	SB
HCM Control Delay, s	5.2	0	17.8
HCM LOS			C

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1126	-	-	-	479
HCM Lane V/C Ratio	0.145	-	-	-	0.42
HCM Control Delay (s)	8.7	0	-	-	17.8
HCM Lane LOS	A	A	-	-	C
HCM 95th %tile Q(veh)	0.5	-	-	-	2

Intersection						
Int Delay, s/veh	4.6					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	100	50	50	995	770	335
Future Vol, veh/h	100	50	50	995	770	335
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	2	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	109	54	54	1082	837	364

Major/Minor	Minor2	Major1	Major2			
Conflicting Flow All	2209	1019	1201	0	-	0
Stage 1	1019	-	-	-	-	-
Stage 2	1190	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	~ 49	288	581	-	-	-
Stage 1	348	-	-	-	-	-
Stage 2	289	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	~ 44	288	581	-	-	-
Mov Cap-2 Maneuver	182	-	-	-	-	-
Stage 1	316	-	-	-	-	-
Stage 2	289	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	66.5	0.6	0
HCM LOS	F		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	581	-	207	-	-
HCM Lane V/C Ratio	0.094	-	0.788	-	-
HCM Control Delay (s)	11.8	-	66.5	-	-
HCM Lane LOS	B	-	F	-	-
HCM 95th %tile Q(veh)	0.3	-	5.5	-	-

Notes
 -: Volume exceeds capacity \$: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

Intersection						
Int Delay, s/veh	5.4					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	180	10	20	860	655	175
Future Vol, veh/h	180	10	20	860	655	175
Conflicting Peds, #/hr	0	0	8	0	0	8
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	150	-	-	-
Veh in Median Storage, #	2	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	196	11	22	935	712	190

Major/Minor	Minor2	Major1	Major2			
Conflicting Flow All	1794	815	910	0	-	0
Stage 1	815	-	-	-	-	-
Stage 2	979	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	~ 89	377	748	-	-	-
Stage 1	435	-	-	-	-	-
Stage 2	364	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	~ 85	374	742	-	-	-
Mov Cap-2 Maneuver	262	-	-	-	-	-
Stage 1	418	-	-	-	-	-
Stage 2	361	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	53.4	0.2	0
HCM LOS	F		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	742	-	266	-	-
HCM Lane V/C Ratio	0.029	-	0.776	-	-
HCM Control Delay (s)	10	-	53.4	-	-
HCM Lane LOS	A	-	F	-	-
HCM 95th %tile Q(veh)	0.1	-	5.8	-	-

Notes
 -: Volume exceeds capacity \$: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

Intersection												
Int Delay, s/veh	3.6											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	5	5	25	5	5	95	20	785	5	40	625	15
Future Vol, veh/h	5	5	25	5	5	95	20	785	5	40	625	15
Conflicting Peds, #/hr	0	0	34	34	0	0	30	0	35	35	0	30
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None									
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	5	5	27	5	5	103	22	853	5	43	679	16

Major/Minor	Minor2		Minor1		Major1		Major2					
Conflicting Flow All	1757	1740	751	1758	1746	891	725	0	0	893	0	0
Stage 1	803	803	-	935	935	-	-	-	-	-	-	-
Stage 2	954	937	-	823	811	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	66	87	411	66	86	341	878	-	-	759	-	-
Stage 1	377	396	-	318	344	-	-	-	-	-	-	-
Stage 2	311	343	-	368	393	-	-	-	-	-	-	-
Platoon blocked, %								-	-	-	-	-
Mov Cap-1 Maneuver	37	70	386	48	69	330	853	-	-	734	-	-
Mov Cap-2 Maneuver	37	70	-	48	69	-	-	-	-	-	-	-
Stage 1	348	348	-	292	316	-	-	-	-	-	-	-
Stage 2	200	316	-	295	345	-	-	-	-	-	-	-

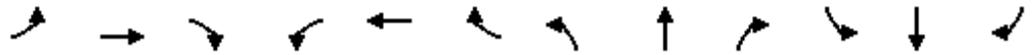
Approach	EB		WB		NB		SB	
HCM Control Delay, s	44.2		36.1		0.2		0.6	
HCM LOS	E		E					

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1WBLn1	SBL	SBT	SBR
Capacity (veh/h)	853	-	-	129	226	734	-
HCM Lane V/C Ratio	0.025	-	-	0.295	0.505	0.059	-
HCM Control Delay (s)	9.3	0	-	44.2	36.1	10.2	0
HCM Lane LOS	A	A	-	E	E	B	A
HCM 95th %tile Q(veh)	0.1	-	-	1.1	2.6	0.2	-

HCM Signalized Intersection Capacity Analysis
9: Kuhio Hwy & Kukui St

Kealia Mauka Homesites

11/05/2018



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕	↗			↗	↖	↖			↕	
Traffic Volume (vph)	35	15	60	0	0	25	35	765	10	5	605	55
Future Volume (vph)	35	15	60	0	0	25	35	765	10	5	605	55
Ideal Flow (vphp)	1900	1900	1900	1900	1900	1900	1900	1200	1900	1900	1200	1900
Total Lost time (s)		4.0	4.0			4.0	4.0	4.0			4.0	
Lane Util. Factor		1.00	1.00			1.00	1.00	1.00			1.00	
Frbp, ped/bikes		1.00	0.87			0.88	1.00	1.00			0.99	
Flpb, ped/bikes		0.94	1.00			1.00	0.99	1.00			1.00	
Frt		1.00	0.85			0.86	1.00	1.00			0.99	
Flt Protected		0.97	1.00			1.00	0.95	1.00			1.00	
Satd. Flow (prot)		1696	1378			1418	1755	1172			1152	
Flt Permitted		0.97	1.00			1.00	0.35	1.00			1.00	
Satd. Flow (perm)		1696	1378			1418	648	1172			1147	
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	16	65	0	0	27	38	832	11	5	658	60
RTOR Reduction (vph)	0	0	55	0	0	23	0	0	0	0	2	0
Lane Group Flow (vph)	0	54	10	0	0	4	38	843	0	0	721	0
Confl. Peds. (#/hr)	30		41	41		30	46		68	68		46
Turn Type	Perm	NA	Perm			Perm	pm+pt	NA		Perm	NA	
Protected Phases		4					5	2				6
Permitted Phases	4		4			8	2			6		
Actuated Green, G (s)		17.6	17.6			17.6	94.4	94.4			86.5	
Effective Green, g (s)		17.6	17.6			17.6	94.4	94.4			86.5	
Actuated g/C Ratio		0.15	0.15			0.15	0.79	0.79			0.72	
Clearance Time (s)		4.0	4.0			4.0	4.0	4.0			4.0	
Vehicle Extension (s)		3.0	3.0			3.0	3.0	3.0			3.0	
Lane Grp Cap (vph)		248	202			207	545	921			826	
v/s Ratio Prot							0.00	c0.72				
v/s Ratio Perm		0.03	0.01			0.00	0.05				0.63	
v/c Ratio		0.22	0.05			0.02	0.07	0.92			0.87	
Uniform Delay, d1		45.1	44.0			43.8	3.7	9.7			12.6	
Progression Factor		1.00	1.00			1.00	1.00	1.00			1.00	
Incremental Delay, d2		0.4	0.1			0.0	0.1	15.1			12.3	
Delay (s)		45.6	44.1			43.9	3.8	24.8			24.9	
Level of Service		D	D			D	A	C			C	
Approach Delay (s)		44.8			43.9			23.9			24.9	
Approach LOS		D			D			C			C	

Intersection Summary		
HCM 2000 Control Delay	26.1	HCM 2000 Level of Service C
HCM 2000 Volume to Capacity ratio	0.83	
Actuated Cycle Length (s)	120.0	Sum of lost time (s) 12.0
Intersection Capacity Utilization	93.7%	ICU Level of Service F
Analysis Period (min)	15	
c Critical Lane Group		

Intersection				
Intersection Delay, s/veh	16.5			
Intersection LOS	C			
Approach	EB	WB	NB	SB
Entry Lanes	1	1	1	1
Conflicting Circle Lanes	1	1	1	1
Adj Approach Flow, veh/h	461	516	315	603
Demand Flow Rate, veh/h	471	527	322	615
Vehicles Circulating, veh/h	505	349	532	600
Vehicles Exiting, veh/h	710	504	444	276
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	13.1	11.0	9.6	27.4
Approach LOS	B	B	A	D
Lane	Left	Left	Left	Left
Designated Moves	LTR	LTR	LTR	LTR
Assumed Moves	LTR	LTR	LTR	LTR
RT Channelized				
Lane Util	1.000	1.000	1.000	1.000
Follow-Up Headway, s	2.609	2.609	2.609	2.609
Critical Headway, s	4.976	4.976	4.976	4.976
Entry Flow, veh/h	471	527	322	615
Cap Entry Lane, veh/h	824	967	802	748
Entry HV Adj Factor	0.980	0.980	0.980	0.980
Flow Entry, veh/h	461	516	315	603
Cap Entry, veh/h	808	947	786	733
V/C Ratio	0.571	0.545	0.401	0.822
Control Delay, s/veh	13.1	11.0	9.6	27.4
LOS	B	B	A	D
95th %tile Queue, veh	4	3	2	9

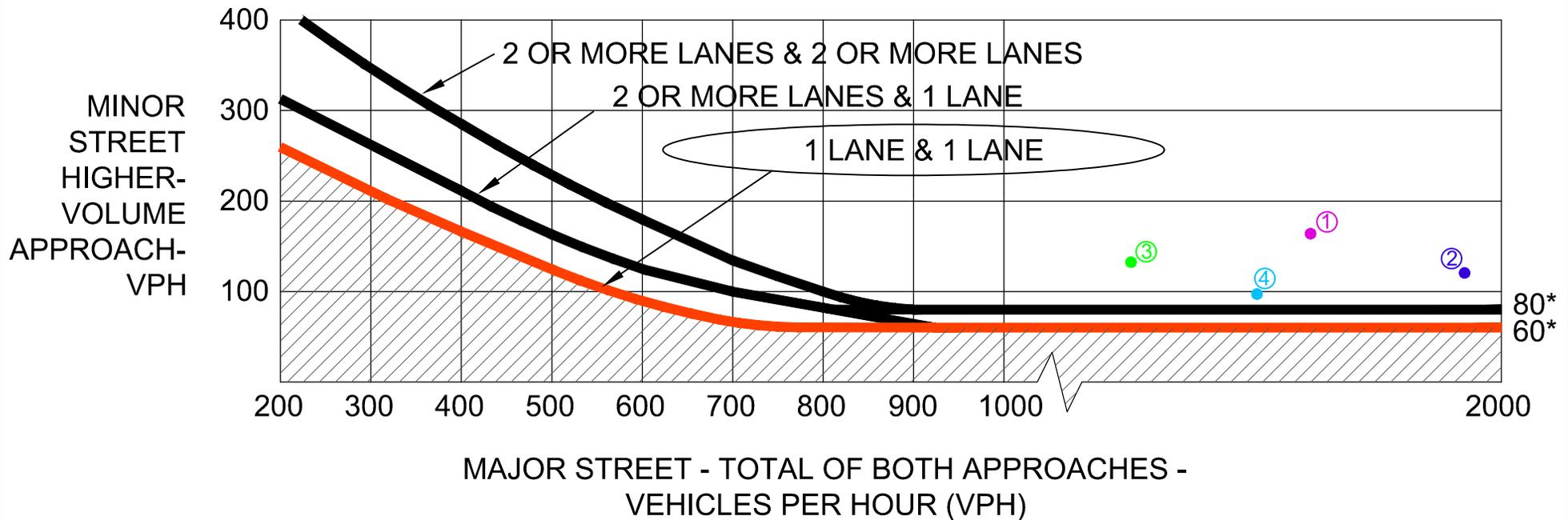
Intersection				
Intersection Delay, s/veh	3.5			
Intersection LOS	A			
Approach	EB	WB	NB	SB
Entry Lanes	1	1	1	1
Conflicting Circle Lanes	1	1	1	1
Adj Approach Flow, veh/h	15	59	169	59
Demand Flow Rate, veh/h	15	60	173	60
Vehicles Circulating, veh/h	105	94	15	60
Vehicles Exiting, veh/h	15	94	105	94
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	3.0	3.3	3.7	3.2
Approach LOS	A	A	A	A
Lane	Left	Left	Left	Left
Designated Moves	LTR	LTR	LTR	LTR
Assumed Moves	LTR	LTR	LTR	LTR
RT Channelized				
Lane Util	1.000	1.000	1.000	1.000
Follow-Up Headway, s	2.609	2.609	2.609	2.609
Critical Headway, s	4.976	4.976	4.976	4.976
Entry Flow, veh/h	15	60	173	60
Cap Entry Lane, veh/h	1240	1254	1359	1298
Entry HV Adj Factor	0.993	0.982	0.979	0.984
Flow Entry, veh/h	15	59	169	59
Cap Entry, veh/h	1232	1231	1330	1277
V/C Ratio	0.012	0.048	0.127	0.046
Control Delay, s/veh	3.0	3.3	3.7	3.2
LOS	A	A	A	A
95th %tile Queue, veh	0	0	0	0

Intersection				
Intersection Delay, s/veh	3.5			
Intersection LOS	A			
Approach	EB	WB	NB	SB
Entry Lanes	1	1	1	1
Conflicting Circle Lanes	1	1	1	1
Adj Approach Flow, veh/h	15	59	169	59
Demand Flow Rate, veh/h	15	60	173	60
Vehicles Circulating, veh/h	105	94	15	60
Vehicles Exiting, veh/h	15	94	105	94
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	3.0	3.3	3.7	3.2
Approach LOS	A	A	A	A
Lane	Left	Left	Left	Left
Designated Moves	LTR	LTR	LTR	LTR
Assumed Moves	LTR	LTR	LTR	LTR
RT Channelized				
Lane Util	1.000	1.000	1.000	1.000
Follow-Up Headway, s	2.609	2.609	2.609	2.609
Critical Headway, s	4.976	4.976	4.976	4.976
Entry Flow, veh/h	15	60	173	60
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Cap Entry, veh/h	1232	1231	1330	1277
V/C Ratio	0.012	0.048	0.127	0.046
Control Delay, s/veh	3.0	3.3	3.7	3.2
LOS	A	A	A	A
95th %tile Queue, veh	0	0	0	0



APPENDIX D
TRAFFIC SIGNAL WARRANT

Warrant 2, Four-Hour Vehicular Volume (70% Factor)



*Note: 80 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 60 vph applies as the lower threshold volume for a minor-street approach with one lane.

- ① AM PEAK, (1650, 165)
- ② PM PEAK, (1935, 120)
- ③ 80% AM PEAK, (1320, 132)
- ④ 80% PM PEAK, (1548, 96)

KEALIA MAUKA
HOMESITES
TIAR

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

**FOUR HOUR TRAFFIC SIGNAL WARRANT FOR FUTURE YEAR 2027
KUHIO HIGHWAY/KEALIA ROAD**

FIGURE

D1