Līhu`e Civic Center Site Improvements Master Plan

FINAL ENVIRONMENTAL ASSESSMENT

Prepared for:
The County of Kaua'i
Department of Public Works - Building Division
Contract #6897

Prepared by:

PBR HAWAII
& ASSOCIATES, INC.

September 2007

LĪHU'E CIVIC CENTER SITE IMPROVEMENTS MASTER PLAN

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PBR Hawaii and Associates, Inc.

This environmental assessment and all ancillary documents were prepared under my direction or supervision and the information submitted, to the best of my knowledge, fully addresses document content requirements as set forth in Sections 11-200-17 and 11-200-18, Hawai'i Administrative Rules, as appropriate.

9/14/07

Donald Fujimoto, P.E. *Date*
County Engineer, Department of Public Works
County of Kaua'i

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PROJECT OVERVIEW

The Līhu'e Civic Center is an approximately 16-acre site in the heart of Līhu'e Town, Kaua'i. It is the government seat of the island, with both County and State offices, and is surrounded by a mix of public uses, commercial, retail and office buildings. It also is the site of civic gatherings, celebrations and parades. Several civic buildings and much of the eastern block of the Civic Center have been listed on both the State and National Registers of Historic Places. This includes the Historic County Building, the Annex and the old State Judiciary building.

In 1989, the County of Kaua'i purchased the old Līhu'e Shopping Center on Rice Street with the vision to expand the existing Civic Center. The 8.7-acre property they acquired comprises the western half of the project site. The vision for the expanded Civic Center is best described in the County's 2000 General Plan Update:

> *The heart of Līhu'e Town is the government and cultural center, surrounded by business and professional offices, shops and restaurants. Landscaping and well-marked pathways link the historic County Building, the Kaua'i Museum, the County Civic Center, and the State Office Building in a campus setting. Parking is primarily provided in a new County-State parking structure located behind the County Office Building, allowing other parts of the campus to be opened up for pedestrian enjoyment. (Kaua'i General Plan Update 2000, p. 6-17)*

While the County has renovated many of the old shopping center buildings into offices and moved several agencies into the renovated buildings, there are remnants of its commercial past still remaining within the Civic Center. This includes the Hawaiian TelCom building, which sits on an outparcel that is not affected by the proposed improvements, a grocery store, and large parking lots surrounding the buildings on all sides. With nearly 50 percent of the site covered by parking (7.8 acres), the property at large still requires site improvements in order to fulfill its vision of a pedestrian-friendly and campus-like setting and to connect the various civic buildings to each other and surrounding uses such as the Kaua'i Museum.

In 2003, the County of Kaua'i Department of Public Works contracted PBR Hawaii to develop a master plan for these site improvements. The plan focuses mainly on improving the pedestrian walkways and the parking areas between and around the County buildings; it does not include architectural programming or significant renovations to the buildings themselves. The plan recommends the closure of 'Eiwa Street to connect the two halves of the Civic Center and unites them with expanded park areas and a pedestrian mall to encourage Civic Center users to walk rather than drive between the Historic County Building on the eastern block and the rest of the County offices on the western block. This is recommended as one of the last phases of the plan to allow improvements to the surrounding streets to precede it and improve existing traffic conditions.

After several community and agency meetings, workshops were held and public input received from 2003 to 2006, the preferred plan has been revised and is submitted as part of this Environmental Assessment (EA) (Figure 1). Before finalizing the plan, the County decided to initiate the Chapter 343 process in order to obtain additional public input.

Q:\Kauai\Lihue Civic Center\Master Plan\Draft Master Plan\Lihue Civic-concept-9.psd

Figure 1
PROPOSED MASTER PLAN
LĪHU'E CIVIC CENTER
COUNTY OF KAUA'I

1.0 INTRODUCTION

This Environmental Assessment (EA) has been prepared in compliance with Chapter 343, Hawai'i Revised Statutes (HRS) for the proposed Līhu'e Civic Center Site Improvements Master Plan.

1.1 PROJECT SUMMARY

Project Name:	Līhu'e Civic Center Site Improvements Master Plan
Location:	Līhu'e, Kalapakī Ahupua'a, Kaua'i, Hawai'i
Judicial District:	Līhu'e
Applicant:	County of Kaua'i, Department of Public Works, Building Division
Landowner and Tax Map Keys:	County of Kaua'i (TMKs: 3-6-05:02, 03, 06, 27 and 28 and portions of Rice, Hardy, and 'Umi Streets and 'Eiwa Street) State of Hawai'i (TMKs: 3-6-05:1, 11, and 30 and portions of Kūhiō and Kaumuali'i Highways)
Project Area:	16 acres more or less
Existing Uses:	Līhu'e Civic Center, parking lots, park, roadways
Proposed Uses:	Site improvements to the Līhu'e Civic Center including new pedestrian paths, expanded park areas, and new parking, bicycle and bus facilities. Potential sites for public art, gateway features and landmarks are also identified in the master plan.
Land Use Designations:	State Land Use: Urban Kaua'i General Plan: Urban Center County Zoning: General Commercial (C-G) and Residential/Special Treatment District-Public Facilities (R-1/ST-P)
Special Management Area (SMA):	Not within the SMA

Need for Assessment:	Compliance with Chapter 343, Hawai'i Revised Statutes Use of County lands and funds, Use of State lands, and Use within a Historic District as designated in the Hawai'i and National Registers of Historic Places
Permits/Approvals Required:	Compliance with Chapter 343, Hawai'i Revised Statutes Permission to perform work within State Highway Right-of-Way Historic Site Review National Pollutant Discharge Elimination System (NPDES) Street Closure Resolution County Zoning Permits
Accepting Agency:	County of Kaua'i, Department of Public Works
Determination:	Finding of No Significant Impact (FONSI)

1.2 LOCATION

The Līhu'e Civic Center is located within Līhu'e Town, Kalapakī Ahupua'a on the island of Kaua'i and is bounded to the north by Hardy Street, to the south by Rice Street, to the west by Kūhiō Highway, and to the east by 'Umi Street. Figure 2 shows a regional location map of the project site and Figure 3 is an aerial photograph of the area.

1.3 LAND OWNERSHIP

The County of Kaua'i is the fee owner of the parcels identified as tax map keys: 3-6-05: 02, 03, and 06. It is also the owner of 'Eiwa Street and the portions of Rice, Hardy and 'Umi Streets included in the master plan. The State of Hawai'i is the fee owner of the parcels identified as tax map keys: 3-6-05:1, 11, and 30 and the portions of Kūhiō and Kaumuali'i Highways included in the master plan. A tax map highlighting the project areas is provided in Figure 4.

1.4 IDENTIFICATION OF APPLICANT

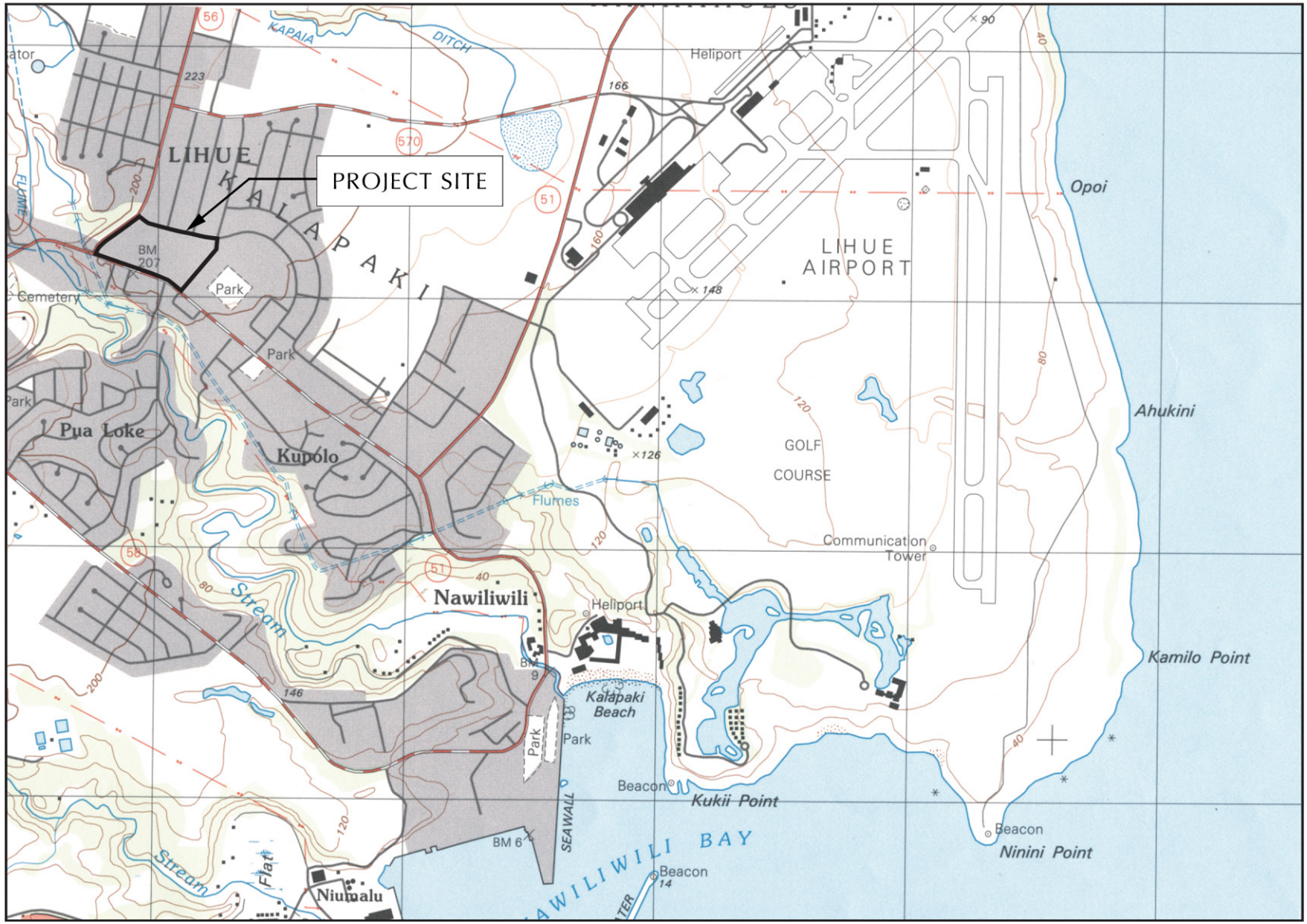
The applicant is the County of Kaua'i Department of Public Works (DPW).

Contact: Douglas Haigh, Building Division Chief
County of Kaua'i Department of Public Works
4444 Rice Street, Suite 175
Līhu'e, Hawai'i 96766
Telephone: (808) 241-6655
Fax: (808) 241-6806

1.5 IDENTIFICATION OF ENVIRONMENTAL CONSULTANT

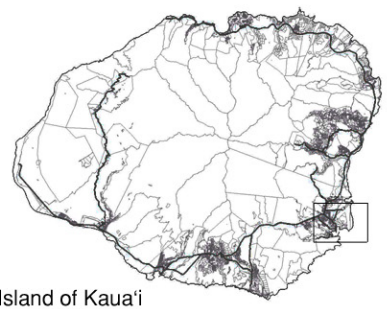
The County of Kaua'i Department of Public Works' consultant for the project is PBR HAWAII.

Contact: Kimi Yuen, Associate
PBR HAWAII
1001 Bishop Street
ASB Tower, Suite 650
Honolulu, Hawai'i 96813
Telephone: (808) 521-5631
Fax: (808) 523-1402



LEGEND

Project Boundary



Source: USGS 1996

Figure 2
Regional Location Map

LĪHU'E CIVIC CENTER SITE IMPROVEMENTS

NORTH

LINEAL SCALE (FEET)
0 1,000 2,000 4,000

ISLAND OF KAUA'I

PBR HAWAII

Figure 3
Aerial Photograph of Existing Project Site

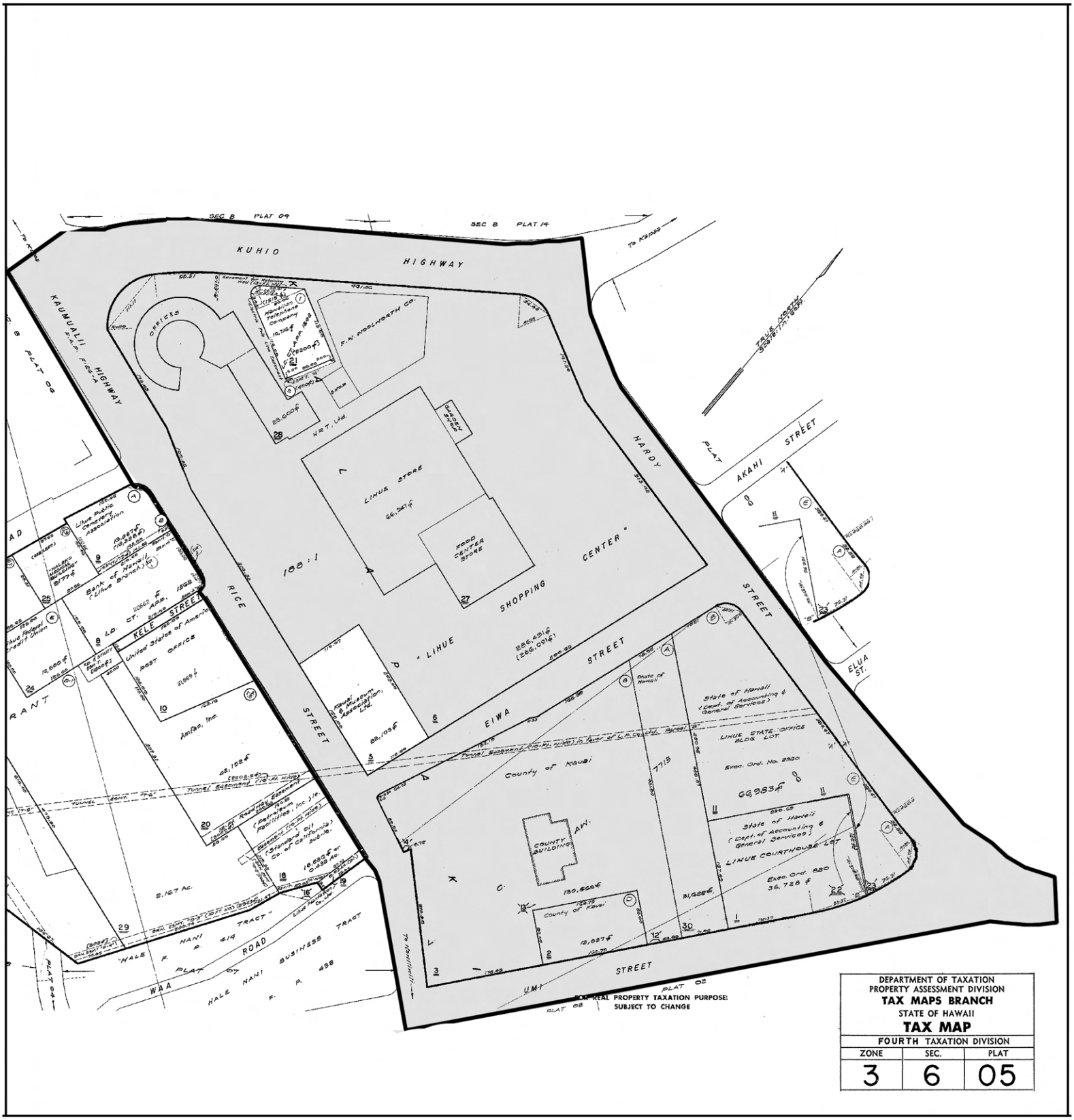
LĪHU`E CIVIC CENTER SITE IMPROVEMENTS

NORTH

ISLAND OF KAUA'I

Not to Scale

PBR HAWAII



DEPARTMENT OF TAXATION
PROPERTY ASSESSMENT DIVISION
TAX MAPS BRANCH
STATE OF HAWAII
TAX MAP
FOURTH TAXATION DIVISION

ZONE	SEC.	PLAT
3	6	05

LEGEND

Project Site

Figure 4
Tax Map

Līhu'e Civic Center Site Improvements

NORTH

ISLAND OF KAUA'I

LINEAL SCALE (FEET)

0 100 200 400

Source: Tax Map (Zone 3, Sec.6, Plat 6)

Disclaimer: This graphic has been prepared for general planning purposes only.

1.6 IDENTIFICATION OF ACCEPTING AGENCY

Because this is an agency action, the accepting agency is the County of Kaua'i Department of Public Works, the same as the applicant.

Contact: Donald Fujimoto, County Engineer
County of Kaua'i Department of Public Works
4444 Rice Street, Suite 275
Līhu'e, Hawai'i 96766
Telephone: (808) 241-6600
Fax: (808) 241-6604

1.7 COMPLIANCE WITH STATE OF HAWAI'I AND COUNTY OF KAUA'I ENVIRONMENTAL LAWS

This document has been prepared in accordance with the provisions of the State of Hawai'i's Environmental Impact Statement Law, Chapter 343, HRS and Hawai'i Administrative Rules (HAR) Title 11, Department of Health, Chapter 200, Environmental Impact Rules. Section 343-5 HRS establishes nine (9) "triggers," which require the environmental review process. Implementation of the Līhu'e Civic Center Site Improvements Master Plan will involve: 1) the use of County land and funds, 2) the use of State lands, and 3) use within a Historic District as designated in the Hawai'i and National Registers of Historic Places.

1.8 IDENTIFICATION OF AGENCIES AND COMMUNITY GROUPS CONSULTED

Throughout the planning process for this project, the County of Kaua'i and State of Hawai'i government agencies as well as community groups, organizations and individuals were consulted during small and large group meetings, public surveys, workshops, public hearings and community meetings. In addition, other agencies are being consulted for this EA process. The following is a list of the agencies and participants consulted for the project.

<u>COUNTY OF KAUA'I</u>

- Mayor Bryan Baptiste
- County Council
- Council Services
- Department of Public Works
- DPW-Engineering Division
- Planning Department
- Offices of Community Assistance

- Transportation Agency
- Office of Economic Development
- Civil Defense Agency
- Department of Finance
- Fire Department
- Liquor Control
- County Attorney
- Police Department
- Department of Water
- Prosecuting Attorney
- Personnel Services
- Kaua'i Historic Preservation Review Commission

STATE AGENCIES

- Department of Accounting & General Services (DAGS)
- DAGS-Kaua'i Branch
- Department of Education (DOE)
- Department of Transportation (DOT)
- DOT-Highways Division Kaua'i District Office
- Office of Environmental Quality Control (OEQC)
- Department of Health Environmental Planning Office
- Department of Land and Natural Resources (DLNR)
- DLNR-Division of Forestry and Wildlife, Kaua'i
- DLNR State Historic Preservation Division (SHPD)
- DLNR-SHPD Kaua'i Office
- Office of Planning, DBEDT
- Office of Hawaiian Affairs
- Disability and Communication Access Board
- Wilcox Elementary School

FEDERAL AGENCIES

- US Post Office, Līhu'e Post Office Postmaster

COMMUNITY ORGANIZATIONS, BUSINESSES, AND INDIVIDUALS

- Līhu'e Business Association
- Kaua'i Chamber of Commerce
- Kaua'i Historical Society
- County Building Restoration Committee (CBRC)
- Grove Farm Homestead Museum
- Kaua'i Community Federal Credit Union
- First Hawaiian Bank
- Bank of Hawai'i

- Līhu'e Credit Union
- Big Save, Inc.
- Hawaiian Telcom (formerly Verizon Hawai'i)
- Hale Pumehana, Inc.
- Līhu'e Plantation Building
- Līhu'e Hui
- Marc Ventura (architect for the Kaua'i Museum expansion plans)
- Kaua'i Island Utility Cooperative

1.9 STUDIES CONTRIBUTING TO THIS ENVIRONMENTAL ASSESSMENT

The information contained in this report has been gathered from agency and community consultations, document and historical research, surveys and questionnaires, site visits, and generally available information regarding the characteristics of the site and surrounding area, and a technical study, a Traffic Impact Assessment Report (TIAR). The TIAR is provided in its entirety as an appendix to this EA. Construction cost estimates were also prepared by Rider Hunt Levett & Bailey and are also attached as an appendix to this EA.

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2.0 PROJECT DESCRIPTION

This section provides background information, identifies the project's goals and objectives, describes the proposed improvements, delineates construction activities and provides approximate costs.

2.1 BACKGROUND INFORMATION

2.1.1 Līhu'e Civic Center

The Līhu'e Civic Center is an approximately 16-acre site in the heart of Līhu'e Town, Kaua'i. It is the government seat of the island, with both County and State offices, and is surrounded by a mix of public uses, commercial, retail and office buildings. It is also the site of civic gatherings, celebrations and parades. The project site is bounded by Rice Street, Hardy Street, 'Umi Street, and Kūhiō Highway and bisected into two blocks by 'Eiwa Street. Several civic buildings and much of the eastern block of the Civic Center have been listed on both the State and National Registers of Historic Places. This includes the Historic County Building, the Annex and the old State Judiciary building. (See Figure 3 and Figure 5.)

2.1.2 Project Need

In 1989, the County of Kaua'i purchased the old Līhu'e Shopping Center, an 8.7-acre property directly west of the original Civic Center. Moved by community input, the Council purchased the site with the vision to expand the existing Civic Center and create a central location for the County's headquarters. The vision for the new Civic Center is best described in the County's 2000 General Plan Update:

> *The heart of Līhu'e Town is the government and cultural center, surrounded by business and professional offices, shops and restaurants. Landscaping and well-marked pathways link the historic County Building, the Kaua'i Museum, the County Civic Center, and the State Office Building in a campus setting. Parking is primarily provided in a new County-State parking structure located behind the County Office Building, allowing other parts of the campus to be opened up for pedestrian enjoyment. (Kaua'i General Plan Update 2000, p. 6-17)*

Since then, the County has renovated many of the old shopping center buildings into offices and moved several agencies into the renovated buildings. However, the County felt the Civic Center still required site improvements to bring the vision of the Civic Center to fruition. Currently, large parking lots surround the County buildings with nearly 50 percent of the site covered by asphalt (7.8 acres). There are no sidewalks connecting the two halves of the Civic Center and people often drive from one side to the other. The County of Kaua'i Department of Public Works subsequently contracted PBR Hawaii to develop a master plan of site improvements

for the Līhu'e Civic Center. The proposed master plan for the Līhu'e Civic Center is shown in Figure 1.

2.1.3 Project Objectives

The following project objectives were compiled from input gathered from community members, neighboring businesses, the Līhu'e Business Association, County and State representatives and staff and the project team.

- Create a campus-like Civic Center by increasing public open spaces and landscaped areas. Beautify and expand the County Lawn. Provide more shade by planting more trees.
- Develop a sense of place, have pride in the area. Embody and exude the spirit of a Civic Center.
- Create a safe, convenient, and pleasant pedestrian environment with continuous, ADA-accessible walkways.
- Provide a balanced design solution that supports multi-modal transportation systems and provides accommodations for pedestrians, bicyclists and transit service – not just cars.
- Preserve and accentuate historic buildings.
- Simplify and organize parking.
- Improve safety around the area. Eliminate cut-through vehicle traffic.
- Bring the community back to the Civic Center. Create a place where people can gather, hold special events, eat lunch, where they enjoy spending time.

These objectives played an integral part in the development of the master plan.

2.1.4 Planning Process

In 2003, the County of Kaua'i Department of Public Works contracted PBR Hawaii to develop a master plan for site improvements at the Civic Center to assist the County in identifying improvement projects at the Līhu'e Civic Center and phasing its construction. It did not include significant improvements or changes to the buildings since the County had already initiated or completed most of the building renovations.

At the beginning of the project, kick-off meetings were held with the Līhu'e Business Association and all County department heads. As part of these meetings, a survey was distributed to key stakeholders including all County employees working at the Civic Center and the Līhu'e Business Association. Input was also sought from the State of Hawai'i and the neighboring businesses and organizations such as the Kaua'i Museum, Hawaiian TelCom (formerly Verizon Hawaii), Big Save, the Līhu'e Post Office, Kaua'i Historical Society, and the surrounding banks, businesses, and office building owners. Small focus group meetings were held in where several early conceptual plans were presented to them and the participants commented and critiqued the various plans.

During the first year of the project, various alternatives were developed and input was gathered from all the County agencies, the State of Hawai'i, neighboring businesses and facilities as well as the Līhu'e Business Association and other interested community members. Multiple conceptual alternatives were developed, reviewed by the project team and interested community members, and refined into a draft master plan for the Līhu'e Civic Center Site Improvements as submitted in July 2005 to the County Council. Input was gathered at various public meetings and posted on the County's website for public input. Input was also received from the County Council on several occasions including meetings to review early alternative conceptual plans in 2004, a workshop in December 2005 and a regular Council meeting in August 2006.

2.2 EXISTING USES

The Līhu'e Civic Center is comprised of County and State government office buildings, the County Lawn, parking lots, and a transit stop (see Figure 3 and Figure 5). There are two outparcels within the project bounds— the Kaua'i Museum and Hawaiian Telcom. Although significant improvements were not considered for these outparcels, improvements to the surrounding streets were considered as part of this master plan.

Historic County Building

Most of the County of Kaua'i offices are located in the Historic County Building on the eastern block of the Civic Center, and in the Mo'ikeha, Pi'ikoi, and Kapule buildings on the western block. The County buildings on the western block were originally built around 1966 as part of the Līhu'e Shopping Center. In 1989, the County purchased the property and has been renovating the interiors into office space in phases. The Mo'ikeha and Kapule Buildings are fully renovated and occupied while there are portions of the Pi'ikoi Building that are currently vacant and available for future offices.

Mo'ikeha Building

On the eastern block, several buildings are considered historic, including the

Historic County Building which was built in 1912, and the State Courthouse and County Annex buildings, both built in the 1930s. The Historic County Building currently houses the County Clerk's office, Councilmember offices, Council Services, and the Elections Division. The building also houses the Kaua'i Historical Society, which maintains a library of historic resources and provides guided history tours and educational programs. The County Annex Building was designed by Hart Wood, a local architectural icon. The building is currently vacant but the County is working on a plan to relocate the Elections Division of the Office of the County Clerk to the Annex.

County Lawn

The County Lawn in front of the Historic County Building is considered historic and is included in within the Līhu'e Civic Center Historic District as described in both the State and National Registers of Historic Places. It includes the double row of royal palm trees that once lined a dirt road that lead to the steps of the Historic County Building. Some of the palms have been removed for safety due to age, illness, or damage sustained during the hurricanes. There are also several large monkey pod trees that edge the County Lawn and several memorial and commemorative sculptures on the east and west corners facing Rice Street. Some community members have voiced concern over filling the historic County Lawn with too many memorials.

Līhu'e Courthouse

Three parcels at the northeast corner of the Civic Center are State-owned. They consist of the former Līhu'e Courthouse lot, the State Office Building parcel, and a metered outdoor parking lot which connects to the adjacent County parking lot within a looped driveway. The historic Courthouse building is a two-story building with one level partially sunken below grade, pitched tiled roof and stucco exterior. In contrast, the State Office Building is a modern, four-story structure with below-grade parking.

State Office Building

There are two commercial uses within the Civic Center project bounds. One of them is

Hawaiian TelCom, the local telephone company. It is nestled between the County's Mo'ikeha and Kapule buildings but it owns the parcel on which its building is located. The other commercial use is the Līhu'e Big Save Market, which is physically adjoined to the County's Pi'ikoi Building. Big Save currently leases the space from the County on a short-term, five-year lease, which has been renewed until 2010.

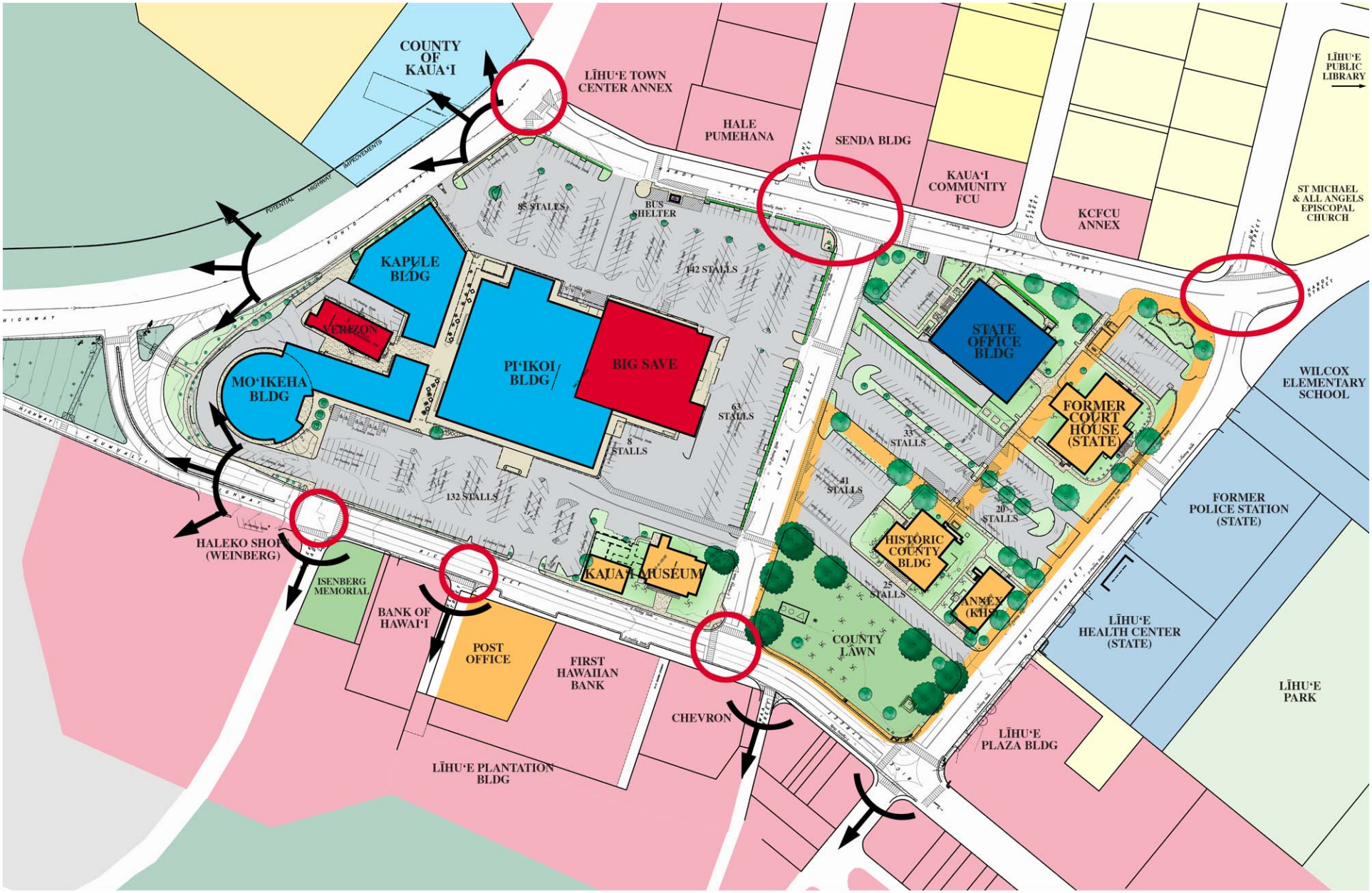
Four roadways form the boundaries of the project site. On the south, Rice Street is a four-lane collector road that runs east-west connecting Kūhiō Highway with Nāwiliwili Harbor. Historically, it is one of Līhu'e's main streets with several commercial uses lining both sides of the street. Many in the community voiced concern that the widening of the street to four lanes and relocation of crosswalks near the Civic Center have made it difficult to cross between the Civic Center and the Līhu'e Post Office and would like to see this area made more pedestrian friendly.

Narrow sidewalk on the Civic Center side of Rice Street. Kou trees planted in narrow landscape strip crowd pedestrians towards oncoming traffic.

On the west, Kūhiō Highway is a major four-lane roadway which carries regional traffic to, from and through Līhu'e. Just north of the Civic Center it is flanked on both sides by commercial uses. However, right across from the Civic Center, the topography drops off into a large depression that is part of a drainageway that connects to Nāwiliwili Gulch.

View of Hardy Street near the bus stop. There are no sidewalks on the Civic Center side of the street (left side of photo).

Hardy Street on the north side of the Civic Center connects Kūhiō Highway on the west to Rice Street on the east. It is a two-lane roadway with a 60-foot right-of-way. Adjacent to the Civic Center, there are sidewalks on the north side of the street but none on the south side along the Civic Center. The County's bus stop is also located on the south side of Hardy Street.



LEGEND

- HISTORIC BUILDING/ PROPERTY
- COUNTY USE/PROPERTY
- STATE USE/PROPERTY
- COMMERCIAL USE
- RESIDENTIAL USE
- TRAFFIC CONFLICTS/LOW L.O.S.
- VIEWS

Figure 5
Existing Project Site

LĪHU'E CIVIC CENTER SITE IMPROVEMENTS

50 25 0 50 150 FEET

PBR HAWAII

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'Umi Street is a two-lane roadway that runs north-south along the east side of the Civic Center. It connects Rice Street to Ahukini Road and also has a 60-foot right-of-way. Similar to Hardy Street, there are no sidewalks on the Civic Center side of the street but there are sidewalks on the opposite side fronting the commercial and office buildings.

View of 'Eiwa Street. No sidewalks on either side of the street.

Splitting the Civic Center in two, 'Eiwa Street provides access to the adjacent parking lots of the Civic Center and is often used by drivers as a short cut through the area. There is on-street parallel parking on both sides of the street but no sidewalks. 'Eiwa Street forms offset intersections with both 'Akahi and 'Elua Streets at Hardy Street on the north and Wa'a Street at Rice Street on the south. These offset intersections make turning movements difficult for drivers.

2.3 SURROUNDING USES

Surrounding the two-block area of the Civic Center is a variety of land uses including commercial and public uses, residential buildings, parks and open space. See Figure 5. South of the Civic Center across Rice Street are several busy commercial uses, including the Halekō Shops, Bank of Hawai'i, First Hawaiian Bank, Līhu'e Credit Union, Chevron gas station, and several office buildings. Also on Rice Street are the historic Līhu'e Post Office, which is heavily used, and the Isenberg Memorial, a small park at the corner of Halekō Road.

North of the Civic Center, opposite Hardy Street, are several commercial, retail and office buildings. They include the Kaua'i Community Federal Credit Union and its Annex, the Senda Building, Hale Pumehana, and the Līhu'e Town Center Annex which has a mix of retail and office space. Northeast of the Civic Center at intersection of Hardy and 'Umi Streets are two public uses— the Līhu'e Public Library and St. Michaels and All Angels Episcopal Church.

East of the Civic Center, across 'Umi Street, are more offices and commercial businesses. The Līhu'e Plaza Building is a two-story building at the corner of Rice and 'Umi Streets with a mix of retail and office spaces. Further north are several public uses including the State Health Center, Wilcox Elementary School, and the

former police station. Līhu'e Park and the Kaua'i War Memorial Convention Hall are further east on the interior of the neighboring block.

West of the project site, opposite Kūhiō Highway is a large drainageway on Kaua'i County and Amfac/Līhu'e Plantation property. The drainageway connects under the highway to the old Līhu'e Mill site and to Nāwiliwili Stream.

2.4 DESCRIPTION OF THE PROPOSED SITE IMPROVEMENTS

2.4.1 Proposed Master Plan

The proposed master plan for the Līhu'e Civic Center site improvements project is provided in Figure 1. It addresses the various goals and visions for the Civic Center, creating a pedestrian-friendly, campus-like environment by closing 'Eiwa Street to through traffic, unifying the two-block site, and opening the site to more park and open space. It recommends creating pedestrian promenades and pathways to connect the civic buildings to one another, and centralizing parking in parking structures to provide expanded park and open space within the Civic Center. Where appropriate, the master plan shows how bicycle and transit facilities can be accommodated within the Civic Center improvements. Opportunities for public art, gateway features and landmarks are also identified.

The focus of the master plan is the public realm between the buildings as well as the adjacent streetscapes. The proposed master plan does not include any architectural programming or major changes to the existing buildings but it does provide general recommendations for the exteriors or accesses where relevant.

In addition, the master plan does not include major changes to the two outparcels within the Civic Center project bounds— the Kaua'i Museum and Hawaiian Telcom. Besides maintaining existing vehicle accesses and pedestrian connections to the surrounding Civic Center, no major site improvements are recommended since the properties are owned by private entities. However, special attention was paid to the alignment of pedestrian connections and views in and around the Kaua'i Museum since the museum is undergoing expansion plans to add an entrance on the north side of the buildings. Input on the Civic Center master plan was specifically sought from the museum's architect in order to coordinate the two projects.

2.4.2 Key Project Components

The following sections briefly highlight some of the important aspects of the master plan. To further illustrate the proposed improvements, simplified computer-generated three-dimensional models are presented below. They show both the existing Civic Center and the Civic Center with the proposed improvements in a series of before and after images. The landscaping in these renderings is meant to be conceptual and is subject to change.

2.4.2.1 Expanded County Lawn and Central Park

One of the main goals and visions for the Līhu'e Civic Center Site Improvements project is to increase the green spaces within the Civic Center. With the proposed closure of 'Eiwa Street, the County Lawn is expanded west to the Kaua'i Museum and a central park is proposed east of Big Save. These improvements will open up the Civic Center's façade along Rice Street with a continuous stretch of greenery and provide multiple locations within the Civic Center for public events.

Before and After Views of the County Lawn

The expanded County Lawn, which will be approximately 36,000 square feet larger, would be improved and landscaped through the replacement of the fallen palms in front of the Historic County Building, the creation of pedestrian walkways, and the installation of more trees and site amenities including benches, trash receptacles and lighting. Similarly, the Central Park will add 37,500 square feet of open space at the center of the Civic Center. A performance space, shade trees and park amenities are envisioned for this park. Depending on need, underground parking could be provided below this park (see Section 2.4.2.4 for more information).

The two expanded open spaces will provide opportunities for the County to host festivals, farmers markets, and other large community gatherings right in the heart of Līhu'e Town. It will provide government workers and nearby residents and seniors with a pleasant place to meet and eat their lunches. It is an opportunity for the Civic Center to become a focal point for the community, a gathering space and a true amenity for those who live and work in Līhu'e.

2.4.2.2 Pedestrian Network and Promenades

To encourage walking within the Civic Center, a pedestrian network with promenades and shaded walkways are proposed. A continuous walkway will connect the Mo'ikeha Building to the Historic County Building and County Annex. The parking spaces in front of the Historic County Building will be replaced with a 30-foot wide promenade. Also, a new walkway connecting this promenade with the sidewalk on Rice Street as well as sidewalks on all sides of the Historic County Building will be installed reminiscent of the old road that used to lead to the Historic County Building and loop around it.

View of the Pedestrian Promenade in Front of the Historic County Building

The covered walkway between the Mo'ikeha, Kapule and Pi'ikoi Buildings will be renovated and the walkway will connect directly to the intersection of Kūhiō Highway and Hardy Street.

Before and After Views of the North Side of the Civic Center Showing Conceptual Pedestrian Paths Linking the Buildings, Parking Areas and Surrounding Streets.

A continuous sidewalk will also be installed on the northern side of the Pi'ikoi Building and will connect to the proposed central park/parking structure to the east of Big Save. Pathways will also connect surrounding public streets and interior parking lots to all State and County Buildings within the Civic Center. Wherever possible, direct links are made from internal pathways to crosswalks in the surrounding streets.

The promenade between the Mo'ikeha Building and Pi'ikoi Building and on the north side of the Kaua'i Museum will be landscaped with medium canopy shade trees. Since the area is adjacent to a loading area, the promenade will be buffered with a wall and/or thick landscaping to shield the sights and sounds of the trucks. Seating areas and trash receptacles will be provided along the promenade so that there are places for people to sit, relax, or have lunch outdoors. Seating areas could be designed as either benches or tree planters with seat walls.

2.4.2.3 Accessibility

Given the relatively flat topography of the Līhu'e Civic Center, all walkways will meet accessibility standards as required by Title II of the Americans with Disability Act (1990). Also, the proposed facilities and pathways will comply with appropriate administrative rules of the State of Hawai'i Disability and Communication Access Board (HAR Title 11 §216-219). Accessible parking stalls and other amenities such as water fountains will be indicated throughout the area with appropriate signs and markers.

2.4.2.4 Parking Facilities

The parking lots within the Civic Center will be redesigned to be more efficient, organized, and landscaped. Canopy trees will be planted to provide shade and reduce the heat island effect within the Civic Center. Pedestrian paths will connect parking areas to the buildings within the Civic Center and provide accessible connections to the public streets.

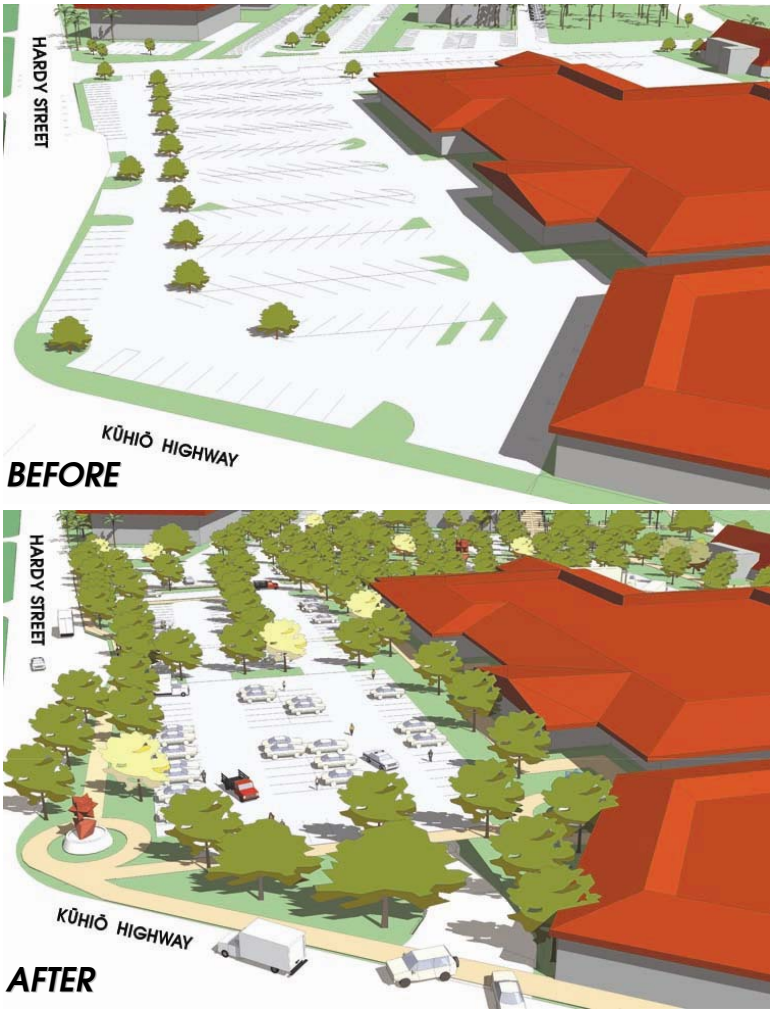
There are a total of 721 parking stalls within the County and State parking lots. This includes 20 parallel parking stalls on 'Eiwa Street. At full build-out, the proposed master plan could have as much as 756 parking stalls, an increase of 35 stalls from existing conditions. No changes to the State parking facilities are proposed except for a minor change in the access to the State's underground parking garage.

Table 1: Parking Summary

	Existing Number of Parking Stalls	Proposed Number of Parking Stalls	Difference
County Parking Lots	556	611*	+55
State Parking Lots	145	145	0
'Eiwa Street	20	0	-20
TOTAL	**721**	**756**	**+35**
*Note: This assumes two parking decks below grade at the Central Park and full build-out of the underground deck at the Hardy Street lot. See discussion in the following text.			

Two locations for potential below-grade parking structures are identified in the master plan. The first is located at the corner of Hardy Street and Kūhiō Highway, as recommended in the County General Plan. It is envisioned as having two parking

levels— one at grade and the other below grade. The topography in this area lends itself well to a below-grade deck. Access to the lower level could be reached directly from Hardy Street (see "before" and "after" renderings below). Other ramps between the two parking decks will be located as appropriate. The estimated capacity of this parking lot could be as much as 260 stalls (125 stalls on the lower deck and 135 stalls at grade). For cost considerations, the lower deck could be half the size to save on grading costs but only about 200 stalls would be provided. Cost estimates for both are provided in Section 2.5.



Before and After Views of the Hardy Street Parking Lot

The area fronting Hardy Street will also be redesigned with a wide sidewalk and shade trees leading to the County bus stop, improving pedestrian accessibility and comfort. The corner of Hardy Street and Kūhiō Highway could also feature a sculpture or other landmark to signal the gateway to the Civic Center.

Central Park with Parking Decks below Grade

A second parking structure is proposed to the east of the Piʻikoi Building. It is envisioned primarily as a central park but with parking decks, as needed, below grade (see rendering below). The design of this area is purposefully left flexible in the master plan. During the development of the master plan, two opposing views regarding parking were voiced. Some felt that ample parking should be provided within the Civic Center and that the number

of parking stalls in the master plan should equal or exceed the current amount. Others felt that the space within the Civic Center was too important to be used for parking and that either the parking should be located offsite or the number of parking stalls should be reduced in order to encourage people to walk or use public transit.

Because this area is one of the last phases of development, the actual design could be determined at a later time after the initial phases of improvements are completed and an updated estimate of parking requirements are studied. To provide some guidance, however, each deck of parking in this designated area is estimated to have 75 parking stalls. In order to match or exceed existing parking counts, two parking decks are required for a total of 150 stalls. This total is included in the parking summary provided in Table 1 and is also used for the cost estimates in Section 2.5. In the other extreme, no underground parking could be provided and the area could be developed into a park. The proposed solution provides flexibility in what is ultimately built and can be weighed against cost and need when appropriate.

The remaining parking areas will be at-grade surface lots and will include sidewalks and landscaping with canopy trees. By redesigning the parking facilities and locating much of the parking below-grade, the amount of landscaped, pervious area is increased by nearly 2.4 acres in the proposed master plan.

Alternate offsite parking areas were also identified in the proposed master plan to help reduce the need for parking within the two-block project site. These include the County's War Memorial Convention Hall parking lot, which has over 240 stalls that could be used for employee parking during work hours, and partnering with neighboring landowners to build public parking near the Līhu'e Plantation Building across Rice Street and the Līhu'e Plaza Building across 'Umi Street. These offsite parking facilities could be structured parking to increase capacity. For example, adding a second level to the War Memorial parking lot would double the capacity to over 400 stalls and could serve as employee parking and public parking for area businesses, park users and the War Memorial. To further support the use of the War Memorial parking lot or any other offsite parking lot for Civic Center users or employees, a frequent shuttle that runs between the Civic Center and the offsite parking lots should be provided.

2.4.2.5 Public Art, Gateway Features, Monuments, & Landmarks

Certain areas in and around the Civic Center have been identified as possible locations for public art and special civic features. They are shown as purple stars in the master plan in Figure 1.

The County Council requested that flagpoles be erected as one of the landmark features. An ideal site for new flagpoles would be at the prominent intersection of Kūhiō Highway and Rice Street fronting the Mo'ikeha Building.

Another significant entry point for the Civic Center is a proposed roundabout at the 'Umi Street and Hardy Street intersection. A large sculpture symbolic of Līhu'e or the Civic Center could be commissioned for this spot. Another option would be to landscape the roundabout with natives or feature landscaping.

Other landmarks or civic features that will be installed include public art, sculptures, fountains, directional signage such as maps of the Civic Center and relocated monuments from the County Lawn. Concern about the growing number of monuments being added to the County Lawn was voiced during some of the community meetings. Some of these monuments could be relocated to the proposed sites which would enable greater public access to them as they would be better showcased along pedestrian paths. It will also clear the County Lawn, opening up the area for public events and festivals.

2.4.2.6 Bicycle and Transit Amenities

To support alternative modes of transportation to and from the Civic Center, bicycle and transit amenities will be provided throughout the Civic Center. Bicycle racks will be provided in at least three places within the Civic Center— at the southwest corner of the Pi'ikoi Building, on the north side of the Pi'ikoi Building, and at the southeast corner of the Historic County Building along the promenade. The County may also install bike racks along public streets, where there is adequate sidewalk widths to support neighboring businesses. Bicyclists would be able to walk their bicycles along any of the pedestrian paths or simply ride in through any of the driveways and parking lots. Bicycle lanes will also be striped in Hardy and 'Umi Streets with shared routes along Kūhiō Highway and Rice Street which are too narrow to provide dedicated bicycle lanes without condemning private property. The bicycle amenities are shown in yellow in the master plan (Figure 1).

To support transit, there will be two bus stops within the Civic Center. The first is the existing stop on Hardy Street which would remain in its current location. The existing shelter would be renovated and a new curb cut provided so the buses can pull out of the traffic lane to make the stop. Sidewalks and landscaping along Hardy Street will also be installed to improve access and comfort for those using the stop. There will also be pedestrian paths connecting the bus stop directly to the Civic Center through the parking lot. The second bus stop would be added at the porte-cochere fronting the Pi'ikoi Building on the Rice Street side of the building. These transit stops are both located off-street and conveniently located for current and future transit routes to and from the Civic Center including the possible Līhu'e shuttle.

2.4.2.7 Landscaping

The landscaping for the Civic Center will include native plants and trees, particularly those symbolic of Kaua'i or historically significant to Līhu'e. The proposed master plan recommends replacing the fallen or missing royal palms and preserving all the large monkey pod trees in the County Lawn. Also, as noted earlier, canopy trees will

be planted along pedestrian promenades and in parking areas to provide shade and comfort. Street trees will be consistent along both sides of the roadway and trees planted in the medians will be more vertical and upright to open up distant views. Street trees along commercial areas will be trimmed so their lowest branches are roughly twelve to fifteen feet high to avoid blocking storefronts and signs.

2.4.2.8 Signage

A variety of signs will be installed at the Civic Center to help visitors navigate around the facilities as well as to inform them of the rich history that surrounds them. The directory and map located between the Pi'ikoi and Mo'ikeha Buildings will be updated and improved so they are legible. A duplicate directory will be installed on the north side of the buildings. Another directory will be located near the Historic County Building or Annex.

Signs and plaques that provide information about the historic buildings and other significant features around the Civic Center will be installed. They will have a consistent design and format to help unify them. They also could be numbered and made part of a walking tour for the Civic Center which could later be expanded to include all of Līhu'e in conjunction with the County's Urban Design Plan for the town core.

2.4.3 Roadway Improvements

A traffic study was prepared by M&E Pacific, Inc. and is attached in its entirety as Appendix A. The traffic study analyzed existing and projected traffic conditions, both with and without the proposed improvements. The study identifies opportunities to balance pedestrian safety and connectivity with vehicle mobility. It also considers community character in its recommendations. The master plan shown in Figure 1 shows proposed roadway improvements for the streets adjacent to the Civic Center based on community priorities and recommendations from the traffic study. The following are brief descriptions of the improvements proposed for the roadways surrounding the Civic Center. More detailed traffic analyses are provided in Section 5.6.1.

2.4.3.1 Rice Street

Within the Civic Center, Rice Street is lined with historic buildings and is envisioned as the "main street" of Līhu'e. However, the street was recently widened to four lanes and a popular crosswalk near Kele Street was removed. Many community members feel that although traffic flows have improved, Rice Street has become dangerous especially for pedestrians. One of the main improvements proposed in the master plan is to realign the existing County driveway with Kele Street and provide crosswalks in all four directions. The intersection will also be signalized to make crossing at this intersection safer.

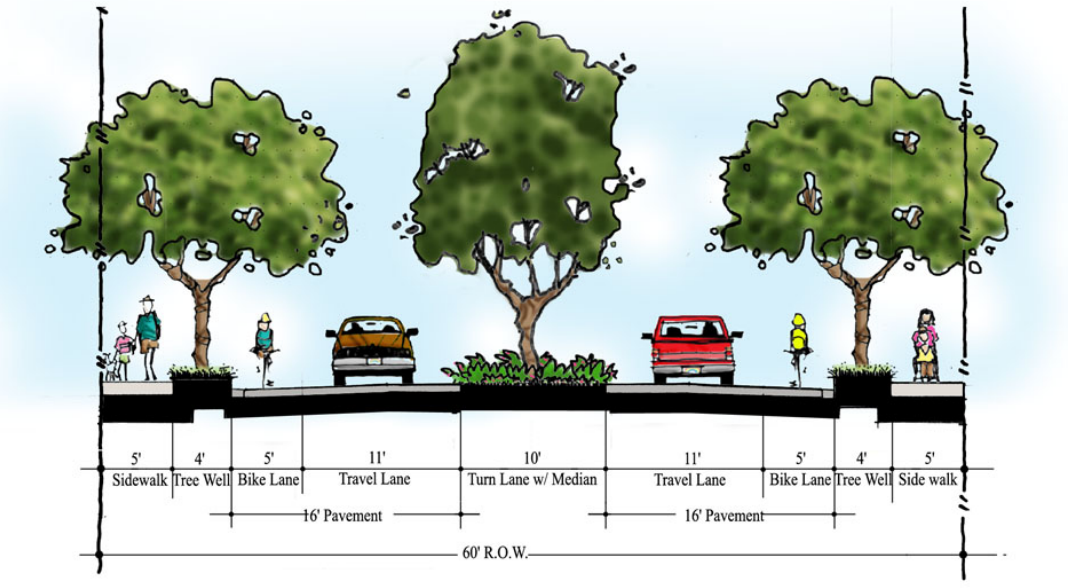
Rendering of New Intersection and Crosswalks at Rice and Kele Streets

In order to break up the roadway and provide a pedestrian refuge, the proposed site improvements include construction of a three-foot landscaped center median. Although the street section along Rice Street varies, wide sidewalks (minimum five feet) and street trees in either tree wells or landscape strips will be provided wherever possible. The recessed parallel parking stalls in front of the Post Office and First Hawaiian Bank will be maintained since the street section in this area is wide enough to accommodate them. Cyclists will continue to share the road, since there is not enough space to include striped bike lanes within the right-of-way.

The existing traffic signals at the intersection of Rice Street and Kūhiō Highway will be adjusted to accommodate forecasted traffic growth. Once Kaumuali'i Highway is widened to four lanes south of Rice Street, two left turn lanes from Rice Street will be built.

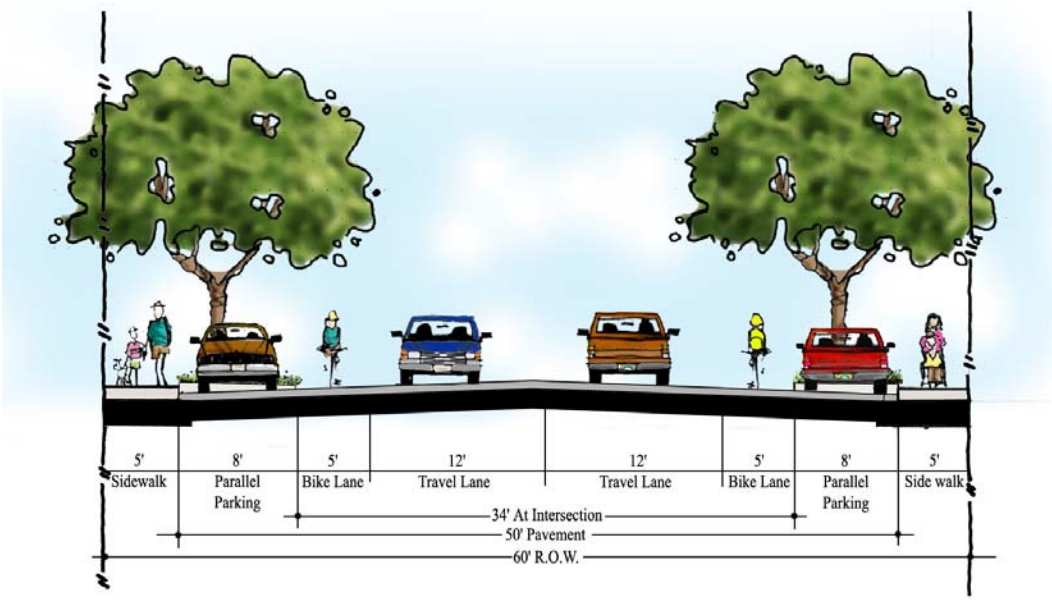
2.4.3.2 Hardy Street

Hardy Street is proposed as a two-lane roadway with a landscaped center median and turn lanes. Bike lanes will be striped on both sides of the street. The intersection of Hardy Street and Kūhiō Highway will be signalized. Existing traffic levels already warrant signalization of this intersection which will improve left turn movements from both Hardy and Kūhiō. A new four-way intersection will be created at Hardy and 'Akahi Streets and the relocated County driveway. Traffic signals will be installed when increases in traffic levels make turning movements difficult. Breaks in the median are provided at every driveway on Hardy Street and left-turn queuing lanes will be provided particularly at the new Hardy/'Akahi/ County driveway intersection, to allow through traffic to pass cars waiting to make left turns from Hardy Street.



Proposed Hardy Street Section

At the intersection of Hardy and 'Umi Streets, a roundabout is recommended due to the unusual geometry of the intersection and the difficulty of signalizing the intersection. A roundabout would not only be cheaper than traffic signals, but it provides an opportunity to create a landmark for the Civic Center and it would not require condemnation of adjacent properties. Crosswalks are setback from the vehicle entry and exit points to provide drivers with a clear view of pedestrians. Splitter islands near the roundabout will help shelter pedestrians crossing the street.



Proposed 'Umi Street Section

2.4.3.3 'Umi Street

Traffic forecasted for 'Umi Street is expected to increase but remain low enough to maintain it as a two-lane roadway. On-street parallel parking is provided to supplement parking needs for the Civic Center. Bike lanes will also be provided.

2.4.3.4 'Eiwa Street

In order to achieve a more campus-like environment, 'Eiwa Street will need to be closed. Although some citizens voiced their concern about losing it as a shortcut between Hardy and Rice Street, the proposed improvements to the other roadways should make turning movements at the remaining intersections easier and safer. The removal of 'Eiwa Street also eliminates the offset intersections of 'Akahi/Hardy/'Eiwa Streets and Rice/Wa'a/'Eiwa Streets. Access to Big Save's loading area will be maintained via a service road which will be paved to look like a pedestrian path but designed to support the weight of the delivery trucks. Removable bollards should be provided along Rice Street so that the service road is not used by cut-through traffic. The service road will be designed to accommodate the wide turning movements of their delivery trucks, including a forty-foot container truck.

2.4.4 Overhead Utilities

All overhead utilities are recommended to be relocated underground within and on roads adjacent to the Civic Center. This will improve views from the Civic Center and reduce the danger of toppling during high wind events. It will also eliminate them from the sidewalks, clearing a wider area for pedestrians and street amenities.

2.5 PROPOSED DEVELOPMENT TIMETABLE AND PRELIMINARY COST ESTIMATES

The proposed phasing plan for the Līhu'e Civic Center Site Improvements project is broken down into eight phases (Figure 6). Phases are not tied to any specific length of time and can be either combined or extended over time depending upon available funds. However, the design of the improvements to Hardy Street is expected to commence later this year.

Figure 6: Preliminary Phasing Plan

Rider Hunt Levett & Bailey prepared construction cost estimates for the proposed master plan. Table 2 summarizes the order-of-magnitude construction cost estimates for each phase. The detailed breakdown of these estimates is provided in Appendix B. The following estimates include a 35 percent contingency.

Other potential costs that may be incurred but are not determined at this time were described throughout Section 2.4. They include items such as offsite parking structures, additional traffic signals at 'Akahi and Hardy Streets, new shuttle bus services and the relocation of overhead utilities underground. These estimated cost of these items are summarized in Table 3 and are subject to change since it is not determined at this time when or if some of these improvements would be implemented.

Table 2: Order-of-Magnitude Cost Estimates by Phase

PHASE AND BRIEF DESCRIPTION	ESTIMATED CONSTRUCTION COST*		
	With Full Build-out of Under-ground Parking	Half of the Underground Parking	No Under-ground Parking
Phase 1: Hardy Street Improvements†	$5,852,000	$5,852,000	$5,852,000
Phase 2: Rice Street Parking Lot with Rice/Kele Street crosswalks and signal	$1,230,000	$1,230,000	$1,230,000
Phase 3: County Lawn Improvements	$698,000	$698,000	$698,000
Phase 4: Hardy Street Parking Lot	$9,096,600**	$5,280,000	$1,475,000
Phase 5: County and State Parking Areas (off 'Umi Street)	$832,000	$832,000	$832,000
Phase 6: Pedestrian Promenade, 'Eiwa Street Closure, Parking	$1,388,000	$1,388,000	$1,388,000
Phase 7: Central Park and Parking Structure	$7,902,000	$4,251,000**	$600,000
Phase 8: Kūhiō Hwy/Rice Street Landscaping	$220,000	$220,000	$220,000
TOTAL	**$27,218,600**	**$19,751,000**	**$12,295,000**

Notes:
**Prepared by Rider Hunt Levett & Bailey (May 2005) unless otherwise noted. All estimates include 35 percent contingency.*
***Extrapolated from Rider Hunt estimates.*
†$3,300,000 of the cost estimate covers work estimated and escalated from the County Department of Public Works 3/22/05 cost estimate. Includes improvements to Hardy Street from Kūhiō Highway to Rice Street.

Table 3: Other Potential Costs

DESCRIPTION	ESTIMATED COST
Parking structure above grade at War Memorial	$35,000 per stall
Parking structure above grade at Līhu'e Plantation Building	$40,000 per stall
Traffic signal at 'Akahi and Hardy Streets	$250,000
Relocation of overhead utility lines underground	$350 per linear foot
Shuttle bus (estimate per service hour)	$59.69 per hour*

**Note: 2002 national average, estimate includes all costs associated with operation (labor, fuel, maintenance, etc.) and was provided by Janine Rapozo, County Executive on Transportation. All other costs prepared by Rider Hunt (May 2005).*

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3.0 LAND USE CONFORMANCE

The processing of various permits and approvals are prerequisites to the implementation of the Līhu'e Civic Center Site Improvements. Relevant State of Hawai'i and County of Kaua'i land use plans, policies, and ordinances are described below.

3.1 STATE OF HAWAI'I

3.1.1 State Environmental Review Law (Chapter 343, Hawai'i Revised Statutes)

The State Environmental Review Law (Chapter 343, Hawai'i Revised Statutes (HRS)) requires an environmental assessment for any action that proposed the use of State or County lands and funds. It also requires one for any improvements in a historic district. This environmental assessment has been prepared in compliance with Chapter 343, HRS as the proposed Līhu'e Civic Center site improvements requires both the use of County land and funds and a historic district.

3.1.2 State Land Use Law (Chapter 205, Hawai'i Revised Statutes)

The State Land Use Law (Chapter 205, HRS), establishes the State Land Use Commission and authorizes this body to designate all lands in the State into one of four districts: Urban, Rural, Agricultural, or Conservation.

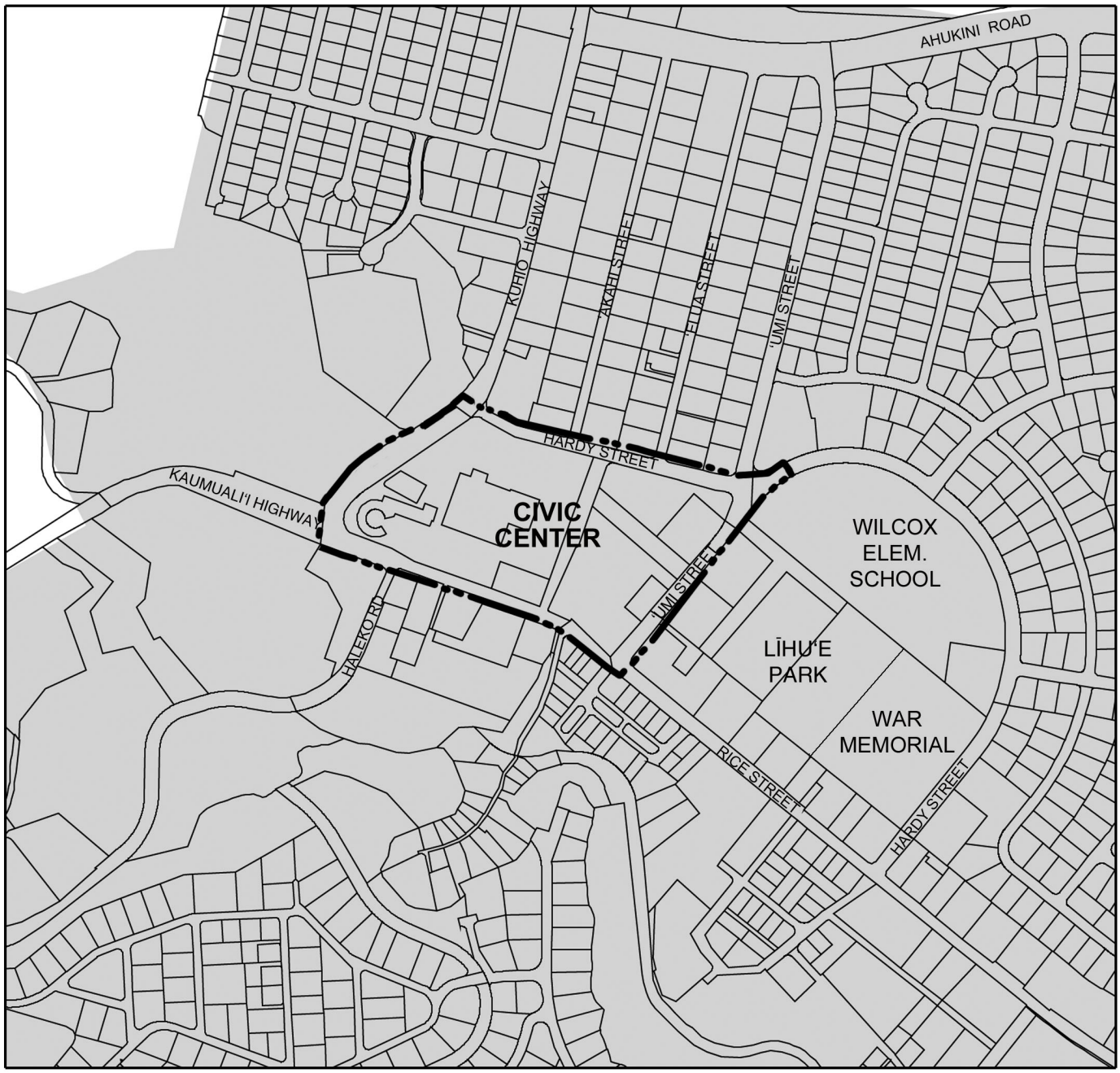
The proposed Civic Center site improvements are located within the State Urban District (Figure 7). The proposed improvements will be consistent with uses allowed within the Urban District.

3.2 COUNTY OF KAUA'I

3.2.1 The Kaua'i General Plan

The General Plan (GP) of the County of Kaua'i is a long-range policy document that fulfills legal mandates of State Law and the Charter of the County of Kaua'i. It is intended to help guide long-range development for the enhancement and improvement of life on Kaua'i, advance the County's vision for Kaua'i and establish the strategies to help achieve that vision including recommended land uses. The GP was last updated in 2000.

According to the GP, the Līhu'e Planning District is considered the "heart" of Kaua'i. On the GP Land Use Map (Figure 8), large portions of Līhu'e are designated as Urban Center, with the Civic Center located at the core.



LEGEND

- Agricultural District
- Urban District
- Project Bounds

Source:
State Land Use Commission (2000)

Disclaimer:
This graphic has been prepared for general planning purposes only.

Figure 7
State Land Use Districts

LĪHU'E CIVIC CENTER SITE IMPROVEMENTS

NORTH
LINEAL SCALE (FEET)
0 300 600 1200
ISLAND OF KAUA'I

PBR HAWAII

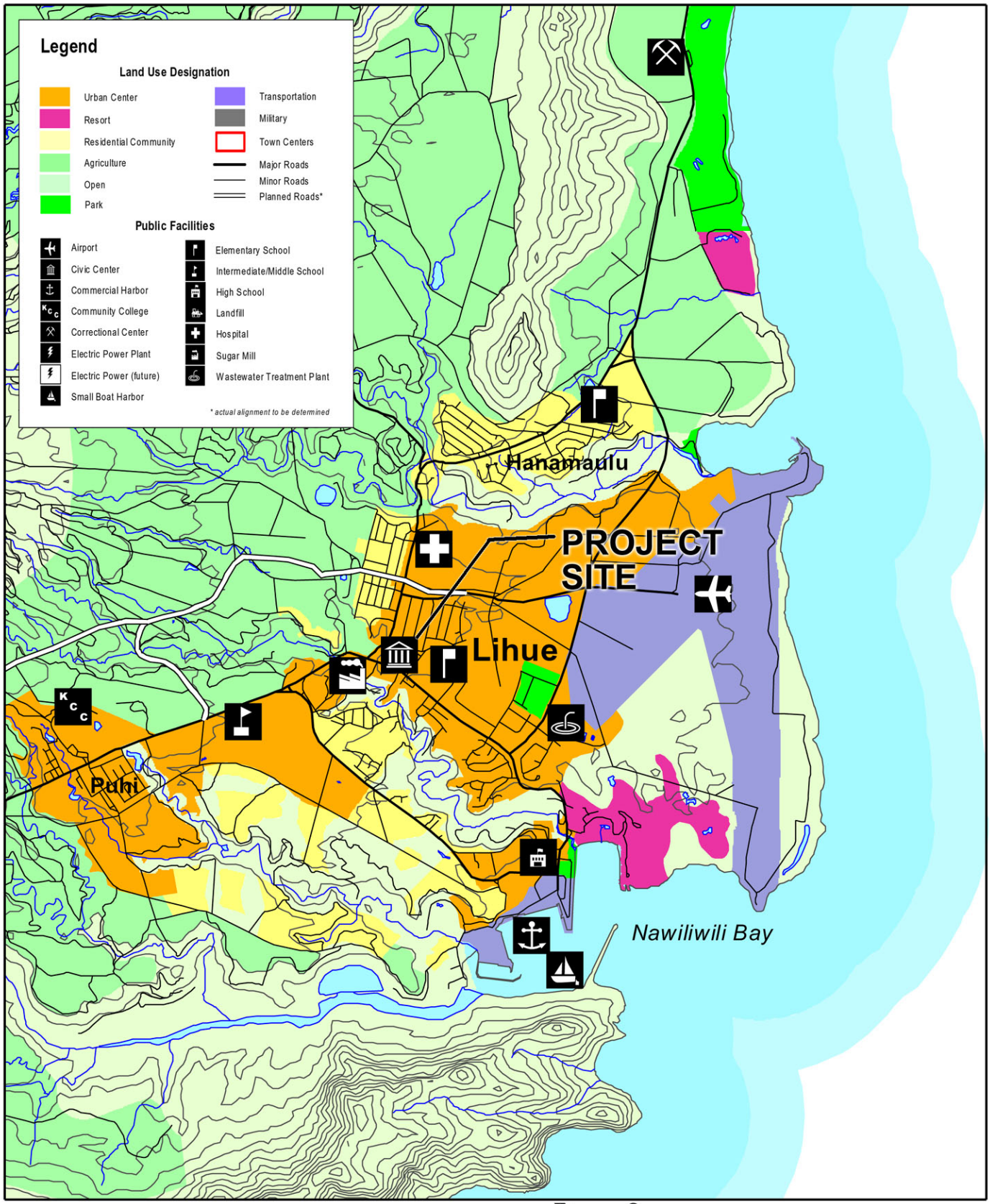


Figure 8
Līhu'e Planning District - Land Use Map
Kaua'i General Plan

Līhu'e Civic Center Site Improvements

Source:
County of Kauai General Plan 2000

Disclaimer:
This graphic has been prepared for general planning purposes only.

NORTH
LINEAL SCALE (FEET)
0 2,000 4,000 8,000
ISLAND OF KAUA'I
PBR HAWAII

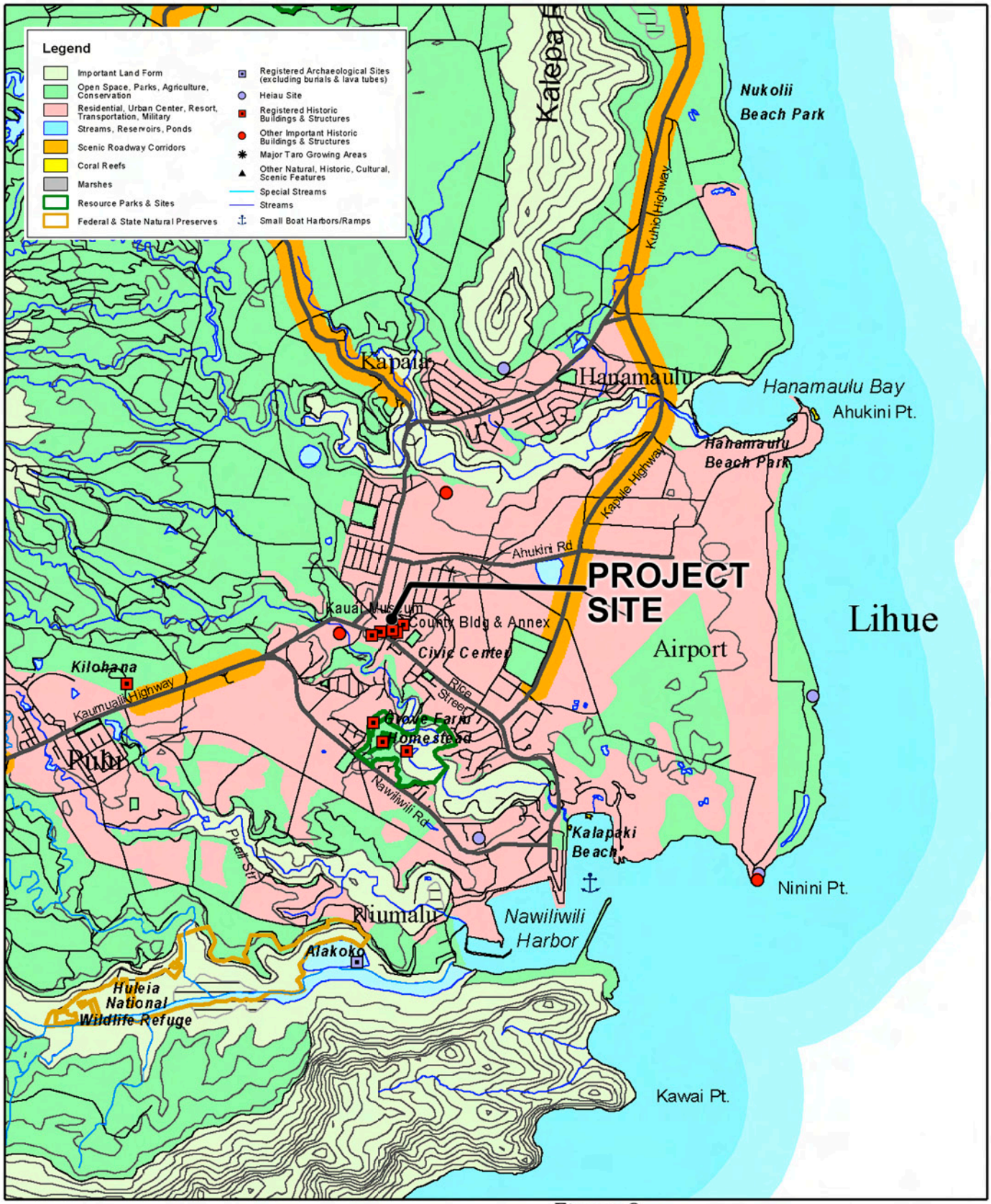


Figure 9
Līhu'e Planning District - Heritage Resources
Kaua'i General Plan

LĪHU'E CIVIC CENTER SITE IMPROVEMENTS

NORTH
LINEAL SCALE (FEET) 0 2,000 4,000 8,000
ISLAND OF KAUA'I

PBR HAWAII

Source:
County of Kauai General Plan 2000

Disclaimer:
This graphic has been prepared for general planning purposes only.

The General Plan also describes the vision for the Civic Center:

> *The heart of Līhu'e Town is the government and cultural center, surrounded by business and professional offices, shops and restaurants. Landscaping and well-marked pathways link the historic County Building, the Kaua'i Museum, the County Civic Center, and the State Office Building in a campus setting. Parking is primarily provided in a new County-State parking structure located behind the County Office Building, allowing other parts of the campus to be opened up for pedestrian enjoyment. The County, the Kaua'i Visitors Bureau, and the Kaua'i Museum collaborate in staffing a visitor center, which provides orientation to Līhu'e and to visitor attractions around the island.* (Kaua'i General Plan 2000, Sec. 6.3.2)

The General Plan also identifies issues and opportunities for renewing Central Līhu'e:

> *Renewal of Central Līhu'e. This has been a long-term goal, as reflected in the 25-year-old Līhu'e Development Plan report. The acquisition and renovation of old Līhu'e Shopping Center for modern County offices was a major step towards this goal. However, revitalization of the Central Līhu'e will require additional government investment and a careful plan to attract visitors and other sources of business – especially in light of the dispersal of new government offices to the Airport area.* (Kaua'i General Plan 2000, Sec. 6.3.3)

The Heritage Resources map for the Līhu'e Planning District is shown in Figure 9. It highlights the area and notes the four historic buildings located within the project site. These are the Historic County Building, the County Annex, the Līhu'e Courthouse, and the Kaua'i Museum's Wilcox Building. It also shows the Līhu'e Post Office across Rice Street and Līhu'e Park to the east.

Discussion: Many of the visions and goals from the 2000 General Plan are incorporated in the design of the Līhu'e Civic Center Site Improvements Master Plan as is the one of the bases for the proposed project. The proposed plan also respects the historic buildings in and around the area, providing better pedestrian access, landscaping, and signage. The proposed master plan is consistent with the County General Plan.

3.2.2 Līhu'e Development Plan

The Līhu'e Development Plan (DP) was last updated in 1976 by EDAW Inc. and Muroda & Associates and was created to coordinate the future development and growth of Līhu'e including the growth of government. The DP ranked the Civic Center as the number one priority in terms of importance and cited the following goals and objectives:

A. Develop a Civic Center plan showing the placement of buildings, design, landscaping
B. Provide area for Civic Center growth

C. Design of Civic Center should reflect the image of the Garden Island
D. Expand and maintain a cultural center

At the time the DP was written, the Civic Center occupied only the block bounded by 'Eiwa, Hardy, Rice and 'Umi Streets. It was assumed that the Līhu'e Shopping Center would remain in its location at the corner of Kūhiō Highway and Rice Street. It did not foresee the eventual conversion of the western block to civic use. Instead, the DP recommended that the County convert the land where Līhu'e Park is located (east of 'Umi Street near the War Memorial) to County and State office space with a smaller, passive Central Park developed between it and the War Memorial. See Figure 10.

In summary, the DP states:

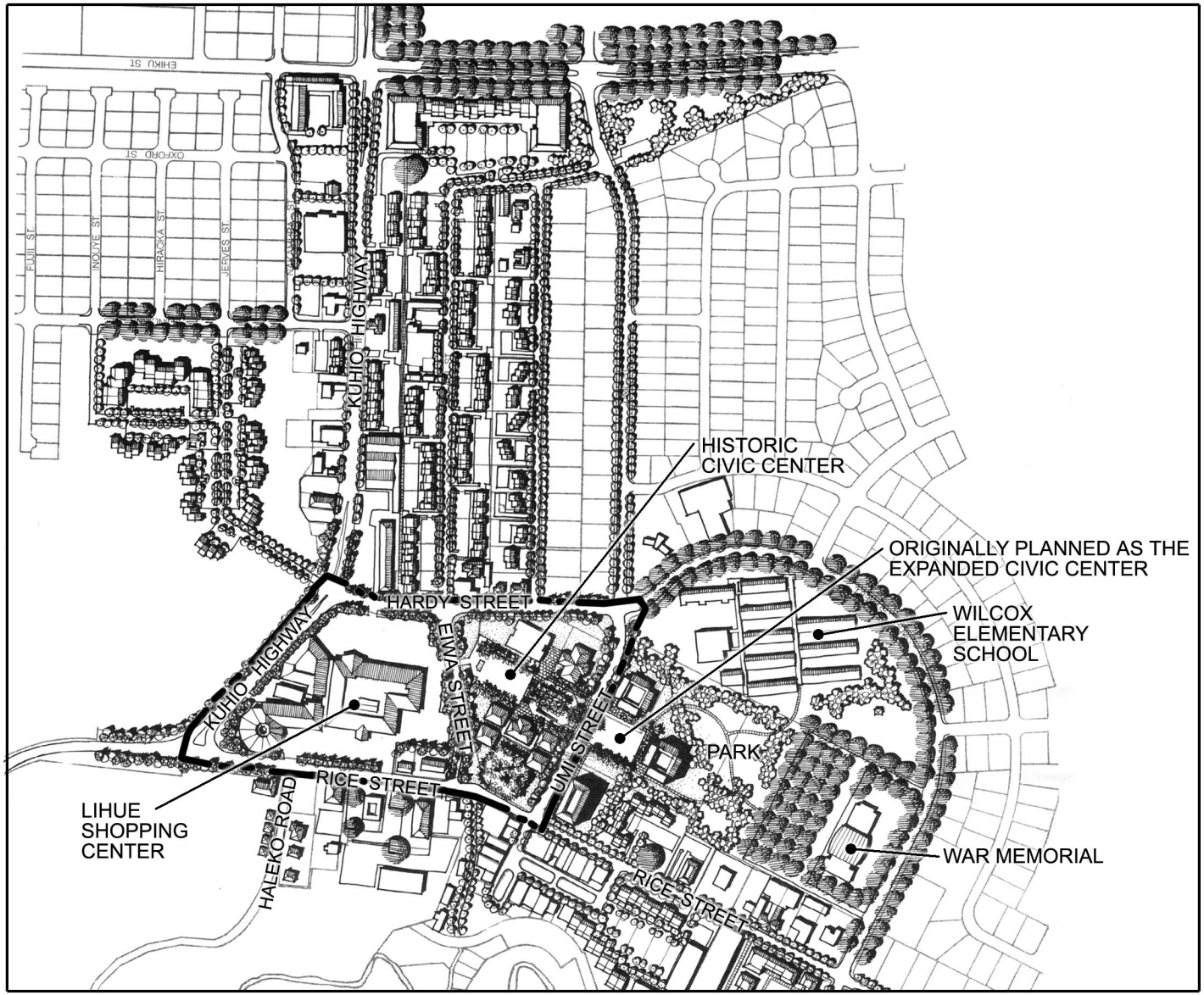
> *This program to develop a larger and better civic center for Līhu'e is consistent with expressed community goals. It is important to note that the present location of the Civic Center is of tremendous significance to the identity of Līhu'e, the proper functioning of the various State and County agencies, and of the valuable interaction between government, private industry, and the public.*

Discussion: While the current location of the expanded Civic Center has shifted to the west rather than the east as proposed the 1976 DP, the general sentiment of a centralized, campus-like Civic Center is still consistent the GP and the proposed site improvements. The Civic Center is still centered around the Historic County Building and the existing configuration actually provides much more space for expansion without encroaching upon Līhu'e Park, which is an important community amenity with its large playfields.

3.2.3 County Zoning

Similar to the State Land Use Districts, the County of Kaua'i Comprehensive Zoning Ordinance (CZO) regulates the type of land uses permitted on the island and their locations. However, the CZO is much more specific and detailed than the State Land Use Districts in its regulation of permitted uses, design standards, and building requirements.

The zoning for the project site is split between General Commercial (C-G) and Residential/Special Treatment District – Public (R-1/ST-P). The C-G portion of the site lies between Kūhiō Highway and 'Eiwa Street (the former shopping center site) and the R-1/ST-P portion lies east of 'Eiwa Street and extends to 'Umi Street (Figure 11). Both zones are compatible with Civic Center uses and the Special Treatment – Public Use District overlay recognizes its civic core. No change in zoning is recommended or required for the proposed site improvements master plan.



LEGEND

Project Bounds

Source:
Lihue Development Plan (EDAW, Inc. and Muroda & Associates, 1976)

Disclaimer:
This graphic has been prepared for general planning purposes only.

Figure 10
Līhu'e Development Plan

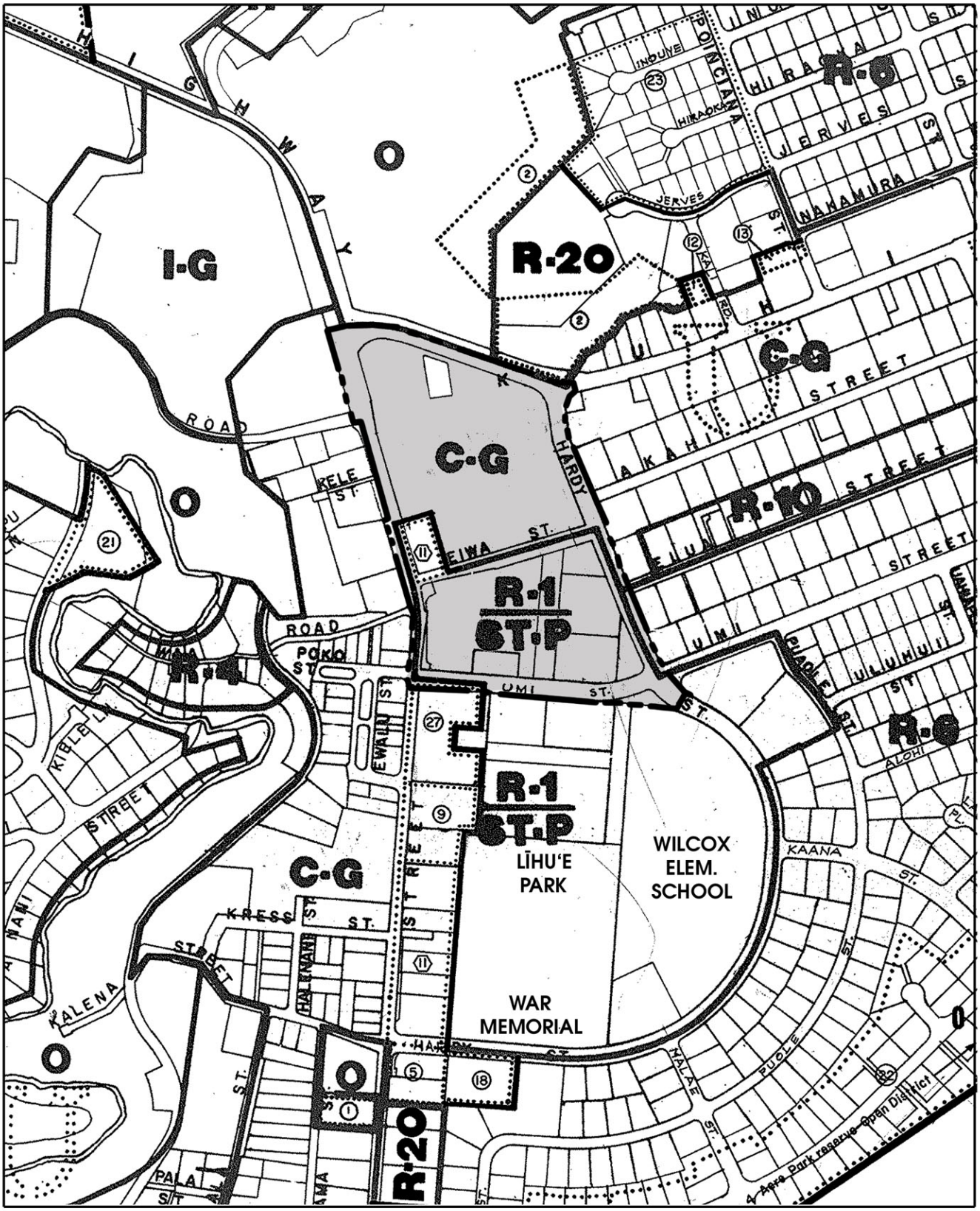
LĪHU'E CIVIC CENTER SITE IMPROVEMENTS

NORTH

LINEAL SCALE (FEET)
0 300 600 1,200

ISLAND OF KAUA'I

PBR HAWAII



LEGEND

Project Site

Source:
County of Kauai Lihue-Kapaia Map (ZM-LI 400)

Disclaimer:
This graphic has been prepared for general planning purposes only.

Figure 11
County Zoning

Līhu'e Civic Center Site Improvements

NORTH

LINEAL SCALE (FEET)
0 250 500 1,000

ISLAND OF KAUA'I

PBR HAWAII

3.2.4 Special Management Area

The Special Management Area (SMA) was established to protect coastal resources in areas extending inland of the shoreline. The subject property is not in the SMA (Figure 12) and therefore does not require any SMA permits.

3.3 FEDERAL

3.3.1 Americans with Disabilities Act (ADA)

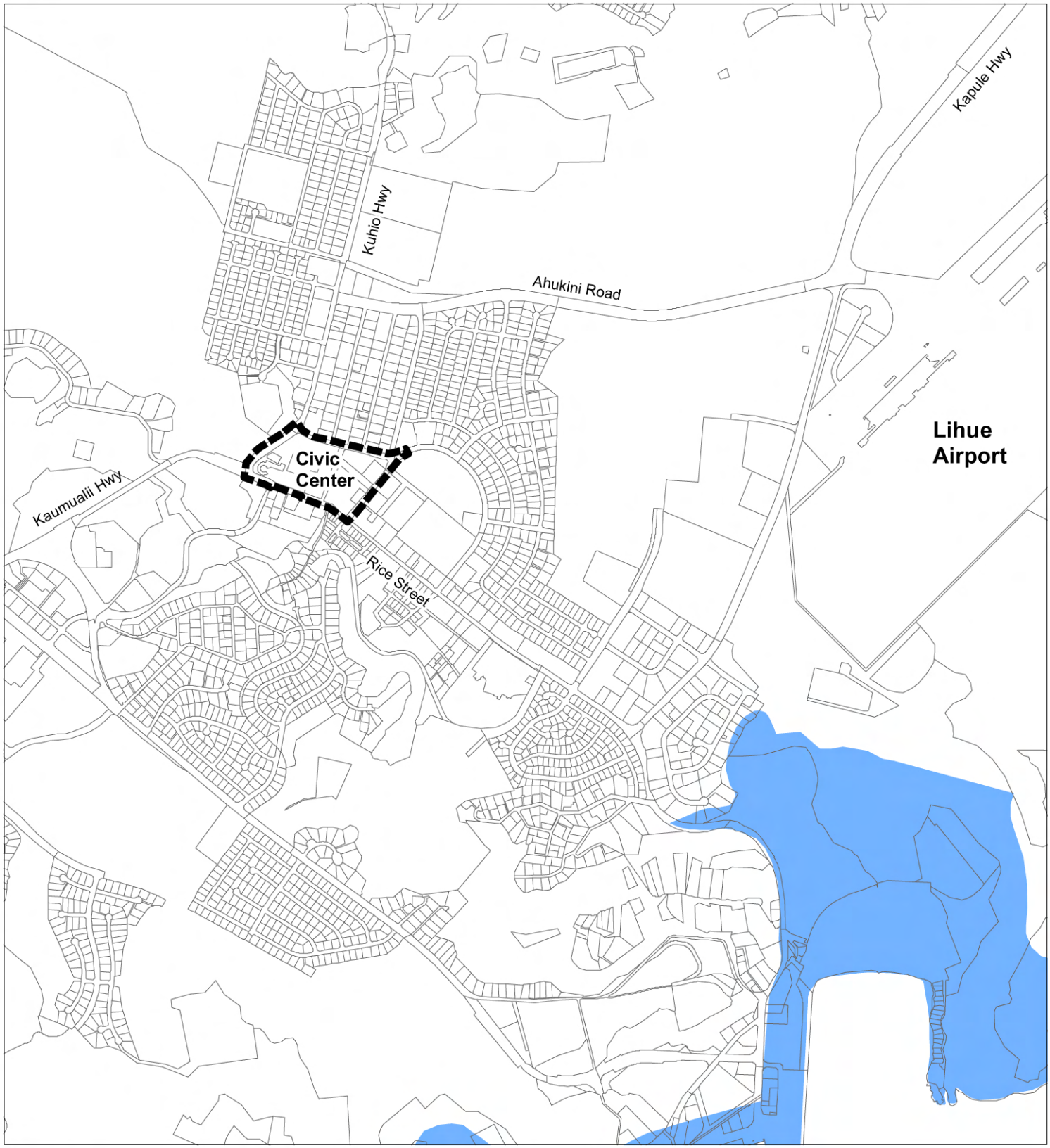
The Americans with Disabilities Act (ADA) of 1990 sets forth guidelines for accessibility to buildings and facilities by individuals with physical disabilities. The proposed site improvements will comply with the guidelines, regulations and recommendations issued by state and federal agencies. Due to the relatively flat topography of the Civic Center, all proposed improvements will be designed to be fully accessible.

3.4 NATIONAL AND STATE REGISTERS OF HISTORIC PLACES

The Līhu'e Civic Center Historic District was added to the State and National Registers of Historic Places in 1981 for its architectural and political significance (Site Number 30-11-9351). The Historic District encompasses the Historic County Building and the County Lawn fronting the structure. It also includes the County Annex and State Courthouse.

Also listed on both the State and National Registers but is not located within the project site is the Kaua'i Museum's Albert Spencer Wilcox Building (Site Number 30-11-9344), added in 1979. The Līhu'e Post Office, located across Rice Street from the Civic Center, was included on the National Register in 1989 and is listed as Site Number 30-11-9342. The historic properties are identified in yellow in Figure 1 and Figure 5.

The proposed changes within the Līhu'e Civic Center Historic District are minor and include mainly landscaping, parking and pathway improvements. No changes are proposed to any of the historic buildings.



Legend

- Project Bounds
- Special Management Area

Figure 12
Special Management Area

Līhu'e Civic Center Site Improvements

ISLAND OF KAUA'I

NORTH

LINEAR SCALE (FEET)
0 750 1,500 3,000

PBR HAWAII & ASSOCIATES, INC.

Source: State GIS

Disclaimer: This graphic has been prepared for general planning purposes only.

3.5 APPROVALS AND PERMITS

The permits and/or approvals required to implement the proposed site improvements are listed in Table 4.

Table 4: List of Anticipated Permits and Approvals

PERMIT/APPROVAL	AUTHORITY
Compliance with Chapter 343 HRS	Office of Environmental Quality Control
Permission to perform work within a State Right-of-Way	State Department of Transportation, Highways Division, Right-of-Way Branch
Historic Site Review	State Historic Preservation Review Division
National Pollutant Discharge Elimination System (NPDES) - General Permit	State Department of Health, Clean Water Branch
Street Closure Resolution	Kaua'i County Council
County Zoning Permits	Kaua'i Planning Department

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4.0 DESCRIPTION OF THE AFFECTED NATURAL ENVIRONMENT, POTENTIAL IMPACTS AND MITIGATION MEASURES

This section describes the existing conditions of the physical or natural environment, potential impacts of the proposed Līhu'e Civic Center Site Improvements on the environment, and mitigation measures to minimize any impacts.

4.1 CLIMATE

4.1.1 Existing Conditions

The average annual temperature recorded for Līhu'e ranges between a high of 81 degrees to a low of 70 degrees Fahrenheit. While January and February are generally the coolest months, August is the warmest. The average relative humidity recorded at Līhu'e Airport is 67 percent in the middle of the afternoon and 83 percent in the early morning hours.

Surface winds are generally around 13 to 24 miles per hour from the northeast. There are some seasonal changes in prevailing wind direction in winter with southerly Kona winds. Strong winds occur at times in connection with storm systems moving through the area. Wind velocities and directions are influenced by the mountainous terrain to the south and west. Daily variations include diurnal effects of winds from the southwest quadrant during the night and morning hours, shifting to the northeast during the day.

Trade wind showers are relatively common and although heavy rains can occur, most of the showers are light and of short duration. The average annual rainfall at Līhu'e Airport is 43 inches, three-fourths of which falls during the wet season from October through April. Normal precipitation in January, the wettest month, is nearly 6 inches, and in June, the driest month, averages 1.69 inches.

4.1.2 Potential Impacts and Mitigation

The proposed Līhu'e Civic Center site improvements are not expected to have an impact on climatic conditions and no mitigation measures are planned.

4.2 GEOLOGY AND TOPOGRAPHY

4.2.1 Existing Conditions

The proposed project area is located south of Kālepa Ridge, an erosional remnant of lava of the original volcanic dome on Kaua'i. It also forms with the Nonou Ridge, the eastern boundary of the Līhu'e Depression, a collapsed caldera.

The rocks of Kālepa Ridge are part of the Nāpali formation of the Waimea Canyon volcanic series of the Pliocene age. The Nāpali formation rocks are gently dipping, thin flows of olivine basalt. Dikes are present in the Nāpali formation of the Kālepa Ridge but their effect on ground water is unknown. In general, these rocks are highly permeable and form an excellent source of groundwater.

Overlying the Nāpali formation and separated by an erosional unconformity are the rocks of the Kōloa volcanic series. These volcanic flows and ash deposits floor much of the Līhu'e Depression.

A topographic survey for the existing project site was performed by M&E Pacific, Inc. The topography of the Līhu'e Civic Center project site is relatively flat, ranging from 196 feet above mean sea level (msl) at the intersection of Rice Street and Kūhiō Highway, to 208 feet above msl at the intersection of Hardy Street and 'Umi Street.

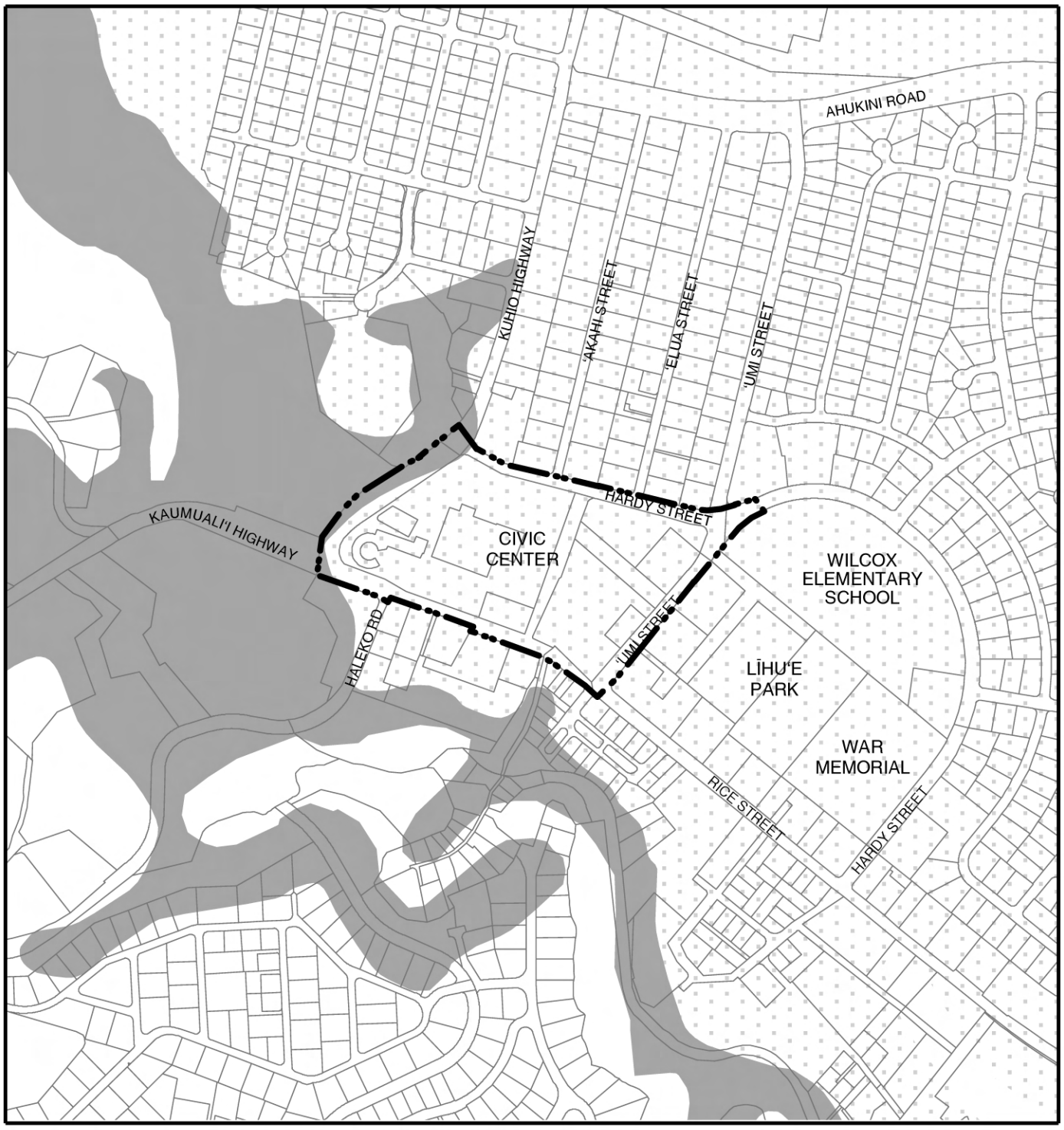
The greatest topographic change occurs along Kūhiō Highway where the topography rises from a low of 196 feet above msl at near Rice Street to a high of 206 feet above msl at Hardy Street (roughly five percent incline). Rice Street has a six percent slope between Kūhiō Highway and Halekō Road and then plateaus at 204 feet above msl from Halekō Road to 'Umi Street. Hardy Street runs flat at 208 feet above msl from Kūhiō Highway to 'Umi Street. Both 'Eiwa Street and 'Umi Street have a slight elevation change of four feet (204 to 208 feet above msl) as the streets go north from Rice Street to Hardy Street (less than one percent slope).

4.2.2 Potential Impacts and Mitigation

The site already has been extensively modified by urban improvements related to the Civic Center as well as the previous shopping center use. Construction will occur in previously disturbed areas and therefore no significant impacts are anticipated. The majority of the proposed Līhu'e Civic Center Site Improvements will require minor grading except for the construction of the underground parking structures which will require major excavation. Throughout construction, appropriate engineering, design and construction measures will be undertaken to minimize potential soil erosion. No significant grading will occur near any of the historic buildings. All ground-altering activity will be conducted in accordance with the Kaua'i County Code. Adverse impacts to landforms and topography associated with grading are not anticipated.

4.3 SOILS

There are three studies prepared for Hawai'i soils whose principal focus has been to describe the potential for agricultural production. They are: 1) the US Department of Agriculture (USDA) Soil Conservation Service (SCS) Soil Survey, 2) the University of Hawai'i Land Study Bureau (LSB), and 3) the State Department of Agriculture (DOA) Agricultural Lands of Importance to the State of Hawai'i (ALISH).



LEGEND

Soil Types

- HnA: HANALEI Silty Clay, 0-2% Slopes
- LhB: LIHUE Silty Clay, 0-8% Slopes
- rRR: Rough Broken Land

Project Bounds

Source:
U.S. Soil Conservation Service (1972)

Disclaimer:
This graphic has been prepared for general planning purposes only.

Figure 13
Soil Conservation Service Soil Survey Map

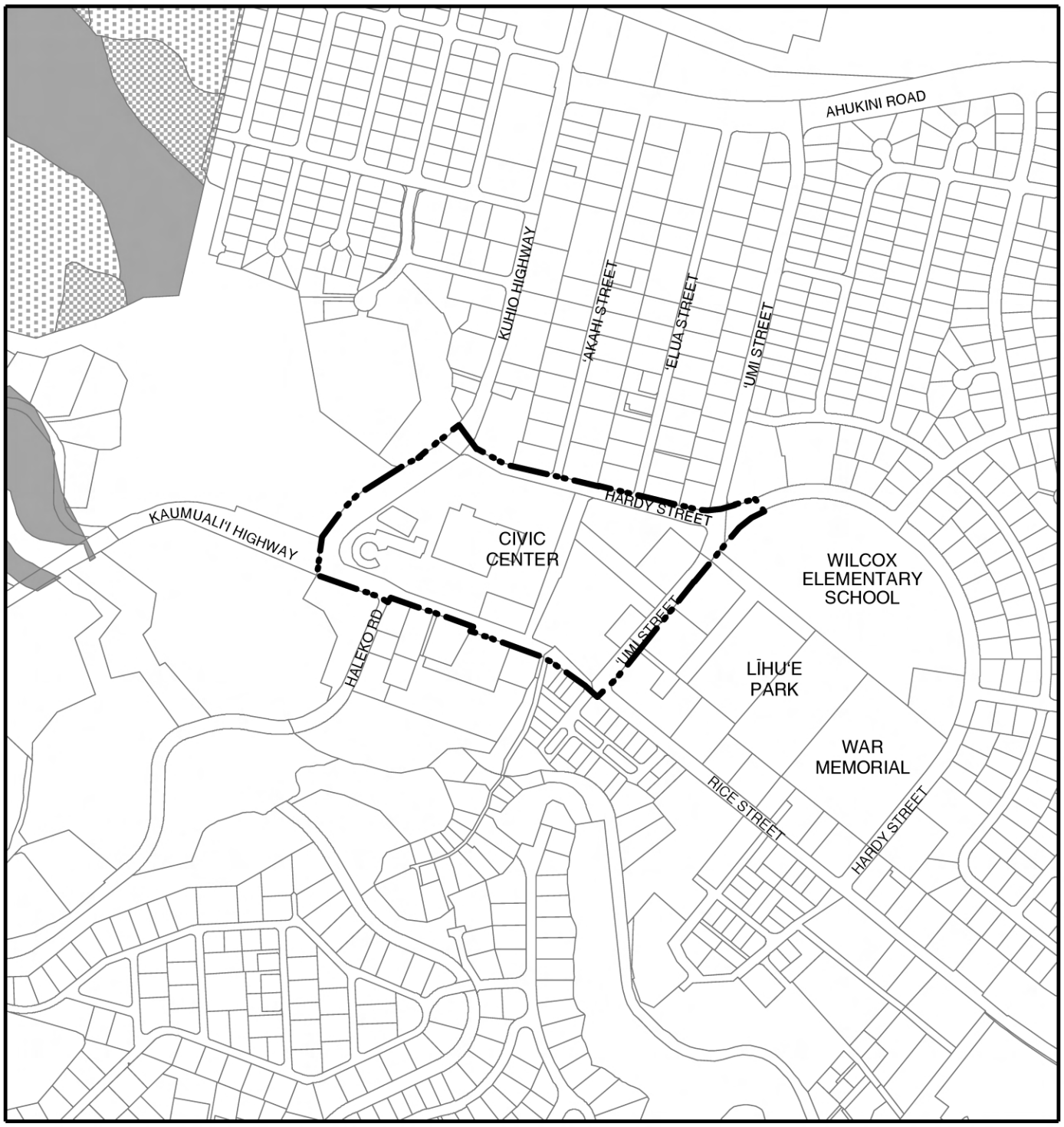
LĪHU'E CIVIC CENTER SITE IMPROVEMENTS

ISLAND OF KAUA'I

NORTH

LINEAL SCALE (FEET)
0 300 600 1,200

PBR HAWAII



LEGEND

Agricultural Land Productivity Ratings

- A (Excellent)
- B (Good)
- C (Fair)
- D (Poor)
- E (Very Poor)
- Not classified

Project Bounds

Source:
Land Study Bureau (1967)

Disclaimer:
This graphic has been prepared for general planning purposes only.

Figure 14
Land Study Bureau

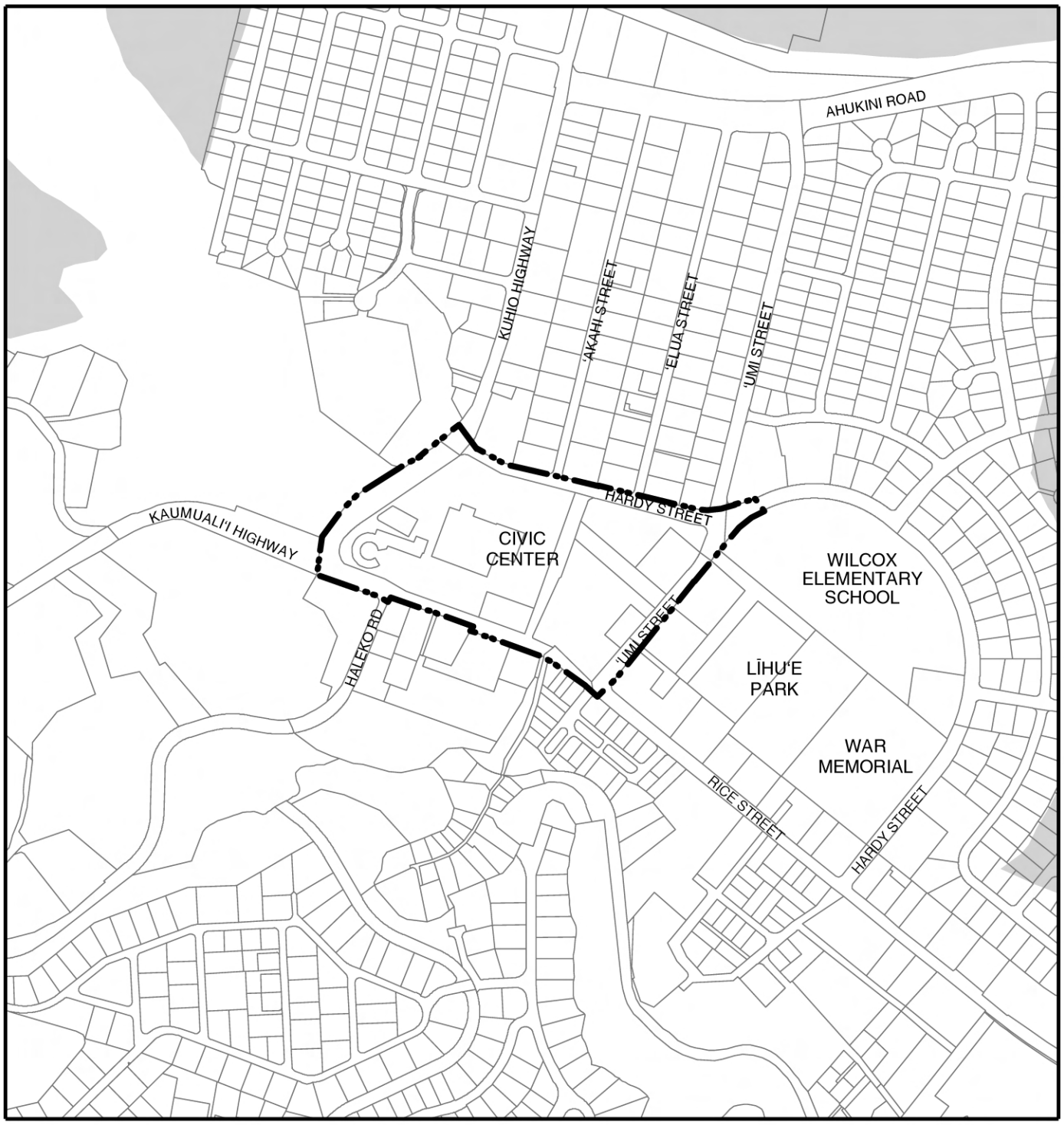
LĪHU'E CIVIC CENTER SITE IMPROVEMENTS

ISLAND OF KAUA'I

NORTH

LINEAL SCALE (FEET)
0 300 600 1,200

PBR HAWAII



LEGEND

ALISH Types

- Prime ALISH Lands
- Not classified

Project Bounds

Source:
State Department of Agriculture (1977)
State of Hawaii GIS Database (2002)

Disclaimer:
This graphic has been prepared for general planning purposes only.

Figure 15
Agricultural Lands of Importance to the State of Hawai'i (ALISH)

LĪHU'E CIVIC CENTER SITE IMPROVEMENTS

ISLAND OF KAUA'I

NORTH

LINEAL SCALE (FEET)
0 300 600 1,200

PBR HAWAII

4.3.1 Soil Conservation Service Soil Survey

The SCS Soil Survey shows that the soils beneath the Līhu'e Civic Center are soils from the Līhu'e-Puhi Association, characterized by deep, nearly level to steep, well-drained soils that are found on uplands and have a fine-textured or moderately fine-textured subsoil. The soils specific to the project site are Līhu'e Silty Clay, with zero to 8 percent slopes (LhB) (Figure 13). This soil typically has a dusky-red strongly acid silty clay surface layer that is about twelve inches thick with 48-inch thick slightly acid to neutral dark-red and dark reddish-brown compact silty clay subsoil with subangular blocky structure. The substratum consists of soft, weathered rock. The soil is primarily found on tops of broad interfluves in the uplands. This soil has moderately rapid permeability, slow runoff and no more than slight erosion hazard. The soil has an available water capacity that is about 1.5 inches per foot of soil. The soil is primarily used for cultivation of sugarcane, pineapple, truck crops or orchards, pasture, wildlife habitat and homesites. The capability classification is IIe, irrigated or non-irrigated. Class II soils have moderate limitations that reduce the choice of plants or require conservation. The subclass is "e," meaning the soil is subject to moderate erosion if it is not cultivated or protected by ground cover.

Along Kūhiō Highway, the bluff is classified as Rough Broken Land (rRR). This soil type consists of very steep land broken by numerous intermittent drainage channels. It occurs in gulches, as in this instance, and erosion is active. The mapping of these areas included areas of colluviums and alluvium along gulch bottoms. This land type is used primarily for watershed and wildlife habitat.

4.3.2 Land Study Bureau Detailed Land Classification

The University of Hawai'i Land Study Bureau (LSB) document titled Detailed Land Classification, Island of Kaua'i, classifies non-urban land by a five-class productivity rating system, using the letters A, B, C, D and E, where "A" represents the highest class of productivity and "E" the lowest. Because the project site is located on urbanized lands, it is unclassified according to the LSB rating system (Figure 14).

4.3.3 Agricultural Lands of Importance to the State of Hawai'i

The State of Hawai'i Department of Agriculture's Agricultural Lands of Importance to the State of Hawai'i (ALISH) system rates agricultural land as "Prime," "Unique" or "Other." The remaining land is not classified.

"Prime" agricultural land is best suited for production of food, feed, forage and fiber crops. The land has the soil quality, growing season and moisture supply necessary to economically sustain high yields of crops when treated and managed including water management, according to modern farming methods.

"Unique" agricultural land can be used for specific high-value food crops. The land has a special combination of soil quality, growing season, temperature, humidity, sunlight, air drainage, elevations, aspect, moisture supply, or other conditions that

favor the production of a specific crop of high quality and/or high yield when the land is treated and managed according to modern farm methods.

"Other" agricultural land is vital to production of food, feed, fiber and forage crops, yet they exhibit properties that are not ideal, such as seasonal wetness, erosion, limited rooting zone, slope, flooding, or drought. The land can be farmed satisfactorily through greater fertilization and other soil amendment, drainage improvement, erosion control practices, and flood protection and can produce fair to good crop yields when properly managed.

According to the ALISH system, the proposed Līhu'e Civic Center Site Improvements area is not classified and therefore, not considered important agricultural land (Figure 15).

4.3.4 Potential Impacts and Mitigation

Implementation of the proposed Līhu'e Civic Center Site Improvements Master Plan is not expected to impact soils with agricultural significance since they are located in an existing urbanized area and do not contain soils of agricultural value.

Construction will involve land disturbance, including removal of existing asphaltic pavement, installation of landscaping, and grading. Excavation will be required where the proposed underground parking structures are located. Impacts to the soils of the proposed Līhu'e Civic Center Site Improvements include the removal of excavated material and the generation of dust during construction. Implementation of the proposed improvements will be conducted in full compliance with dust and erosion control and other requirements of the County of Kaua'i. Best management practices (BMPs) to mitigate any dust and/or silt will be included in the construction plans. As typically required for projects on land greater than one acre in size, a National Pollutant Discharge Elimination System (NPDES) Notice of General Permit Coverage (NGPC) for Storm Water Associated with Construction Activity will be necessary. No improvements are recommended along Kūhiō Highway where the bluff has potential erosion hazards. However, if the County decides to pursue the construction of a parking structure along this bluff, geological and engineering studies should be conducted to see if it would be feasible, safe, and cost-effective.

4.4 NATURAL HAZARDS

4.4.1 Existing Conditions

Natural hazards impacting the Hawaiian Islands include flooding, tsunami inundation, hurricanes, volcanic eruptions, and earthquakes. According to the Flood Insurance Rate Map (FIRM) prepared by the Federal Emergency Management Agency (FEMA), National Flood Insurance Program, the project area is located in Zone X and is outside of the 500-year flood plain. This is an area with a minimal chance of flooding (less than 0.2% annual chance) (Figure 16).

LEGEND

- SPECIAL FLOOD HAZARD AREAS SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD
- FLOODWAY AREAS IN ZONE AE
  - ZONE AE — Base Flood Elevations determined.
- OTHER FLOOD AREAS
  - ZONE X — Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.
- OTHER AREAS
  - ZONE X — Areas determined to be outside the 0.2% annual chance floodplain.
- 513 — Base Flood Elevation line and value; elevation in feet*

* Referenced to the National Geodetic Vertical Datum of 1929

- A — A: Cross section line
- 23 — 23: Transect line
- Project Bounds

Source:
FEMA Flood Insurance Rate Map
(Panel No. 150002 0326E, 2005)

Disclaimer:
This graphic has been prepared for general planning purposes only.

Figure 16
Flood Insurance Rate Map

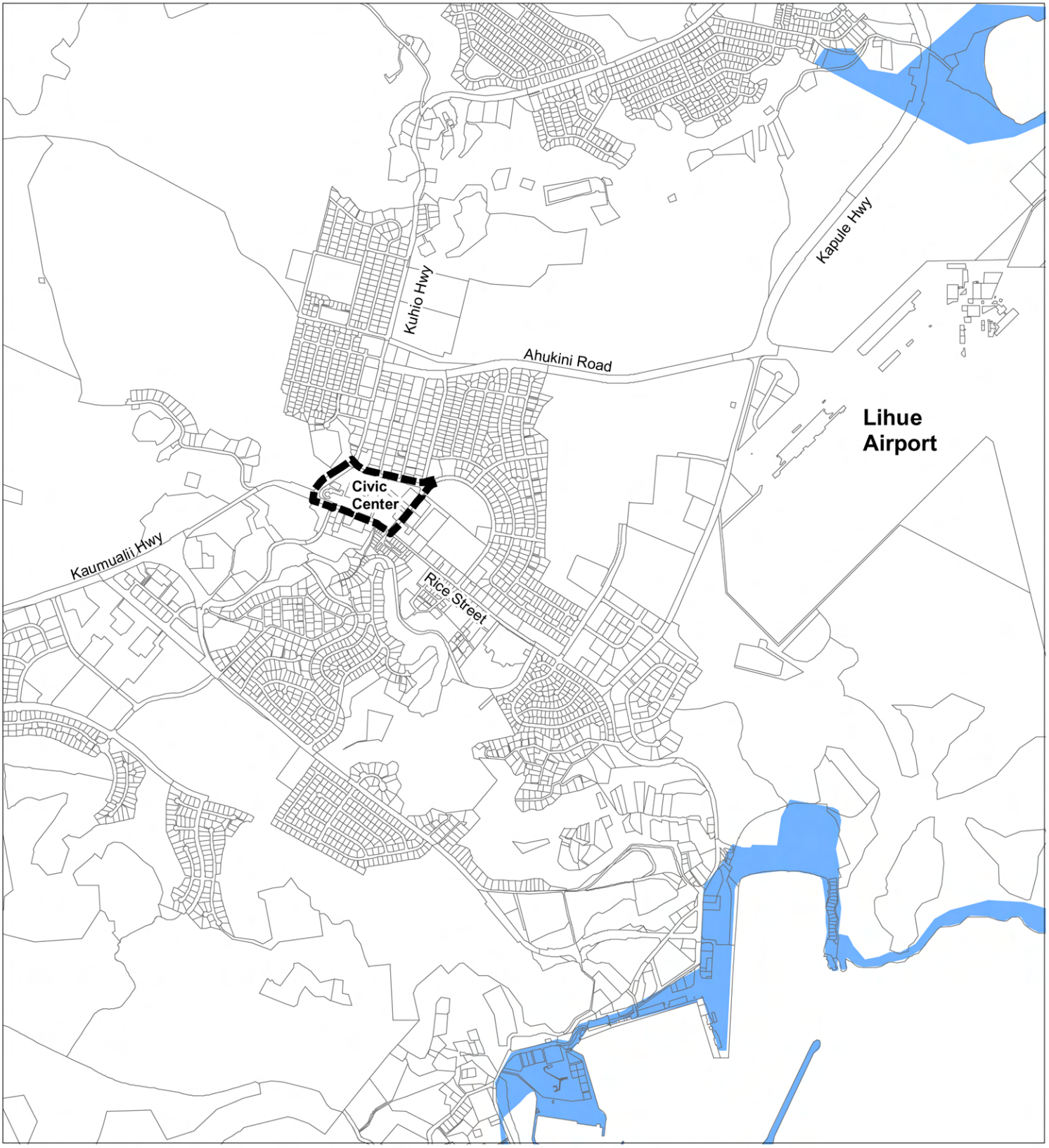
LĪHU'E CIVIC CENTER SITE IMPROVEMENTS

ISLAND OF KAUA'I

NORTH

LINEAL SCALE (FEET)
0 300 600 1,200

PBR HAWAII



Legend

- Project Bounds
- Iniki Overwash Boundary
- Tsunami Evacuation Zone

Source: Pacific Disaster Center (1998); Aerial Photographs taken shortly after Hurricane Iniki

Disclaimer: This graphic has been prepared for general planning purposes only.

Figure 17
Tsunami Evacuation Zone
& Hurricane 'Ini'ki Overwash Boundary

LĪHU'E CIVIC CENTER SITE IMPROVEMENTS

ISLAND OF KAUA'I

NORTH

LINEAR SCALE (FEET)
0 1,000 2,000 4,000

PBR HAWAII & ASSOCIATES, INC.

The tsunami evacuation zone is located far to the east and makai of the proposed Līhu'e Civic Center Site Improvements area. There was no hurricane overwash recorded in the area after Hurricane 'Iniki since Līhu'e is located on a plateau above coastal areas. (See Figure 17.) Much of the damage due to the hurricane overwash was recorded in low-lying coastal areas in Wailua and Kapa'a and along the southern coast of the island.

Since 1980, two hurricanes have had a devastating effect on Kaua'i. They were Hurricane Iwa in 1982 and Hurricane 'Iniki in 1992. While it is difficult to predict such natural occurrences, it is reasonable to assume that future incidents are likely, given historical event. However, the threat of such hazard is no greater for the proposed project site than any other location on Kaua'i.

Volcanic hazard is considered minimal due to the extinct status of the volcanoes comprising Kaua'i.

In Hawai'i, most earthquakes are linked to volcanic activity, unlike other areas where a shift in tectonic plates is the cause of an earthquake. Each year, thousands of earthquakes occur in Hawai'i, the vast majority of which are so small they are detectable only with highly sensitive instruments. The threat of an earthquake to the Līhu'e Civic Center Site Improvements area is no greater than any other location on Kaua'i.

4.4.2 Potential Impacts and Mitigation

The proposed Līhu'e Civic Center Site Improvements will not exacerbate any natural hazard conditions. The project site is located outside the 500-year floodplain and outside of the tsunami evacuation zone. The hurricane overwash boundary recorded after 'Iniki did not encroach upon Līhu'e. Flooding tends to have less of an impact on the Līhu'e Civic Center area since it is located on the top of a plateau. Should there be a hurricane, the potential impact of destructive winds and torrential rainfall will be mitigated through compliance with the Uniform Building Code. All structures will be constructed in consideration of the possibility of earthquake occurrence, in compliance with County building codes and design standards.

4.5 FLORA

4.5.1 Existing Conditions

In front of the Historic County Building at the County Lawn are the historic double rows of royal palms. The palms are estimated to have been there since the 1930s when they once lined the dirt road leading up to the Historic County Building. However, several palms have been removed over the years due to wind damage and age. Around the edge of the County Lawn are several large monkey pod trees. The rest of the eastern block has a mix of trees such as plumeria, autograph, mango, Poinciana, monkey pod, kukui, banyan, coconut, and a variety of palms including

Chinese fan palm, manila and areca. There are also small shrubs and hedges including a hibiscus hedge near the State Office Building and several grassy areas around the buildings and parking lots.

On the western block where the Mo'ikeha and Pi'ikoi Buildings are located, the majority of the existing site is covered with impermeable surfaces—buildings and asphalt. There is very little vegetation. There are two small Japanese gardens fronting the County buildings and bougainvillea plants dot the parking lots facing Hardy and 'Eiwa Streets. There is a single paperbark tree in the parking lot facing Hardy Street. Mock orange hedges front Hardy and 'Eiwa Streets with wedelia in planter beds. At the intersection of Rice Street and Kūhiō Highway, the slope below the Mo'ikeha Building has been landscaped with loulu, areca and Alexander palms, red ginger, bougainvillea, and wedelia. Kou trees have been planted along a narrow planting strip on Rice Street and the pedestrian path between the Pi'ikoi and Kapule Buildings but are struggling. There are also plumeria trees at the entrance of the Mo'ikeha Building with a mix of shrubs in the buildings atrium including raphis palms. Along Kūhiō Highway, parrot beak heliconia, wedelia and jatropha line the sidewalk.

4.5.2 Potential Impacts and Mitigation

Overall, the flora at the Civic Center is a mix of alien and introduced species with a few natives like the loulu, kou, and kukui recently planted. Besides the County Lawn, there is no coordinated landscaping design or theme. The Līhu'e Civic Center Site Improvements Master Plan recommends preserving the large specimen trees like the monkey pods at the County Lawn and others within the historic district. The existing canopy trees that will be preserved are shown as lighter yellow-green trees in the master plan (Figure 1).

The master plan also recommends replacing the missing royal palm trees at the County Lawn and checking the health of the remaining trees to see if replacement of any of the remaining trees is also necessary. While the master plan will be removing some of the existing vegetation, it proposes adding more parks and open space with canopy trees shading pedestrian paths, parking areas and outdoor spaces. It recommends using native plants and plants significant to Līhu'e and Kaua'i. With the added open spaces, over 2.4 acres of impermeable surfaces will be replaced with green, open spaces, reducing the heat island effect and reducing stormwater runoff. The landscape will become more coordinated and welcoming, encouraging workers, residents and visitors to enjoy the outdoor areas of the Civic Center.

4.6 FAUNA

4.6.1 Existing Conditions

Although no formal study of mammalian and avian species has been conducted for this highly urbanized area, it is expected that the species found in the vicinity of the

subject property and surrounding areas are typical of species found in urban Līhu'e. Feral mammals typically include cats, rats, and mice. Common bird species include doves, mynas, sparrows, cattle egrets, Japanese white-eyes, and chickens. The migratory Pacific Golden-Plover or Kōlea (*Pluvialis fulva*) are also known to frequent the area. Newell shearwaters, a threatened species, are also known to fly over Līhu'e between nesting areas in the mountains and foraging areas at sea, and can sometimes become disoriented by urban lights at night. The native Hawaiian Hoary Bat or Opa'epa'e (*Lasiurus cinereus semotus*), which is endangered on all islands except Kaua'i, may also be found in the area due to the project's proximity to 'Alekoko (the Menehune Fish Pond) and Hule'ia National Wildlife Refuge. They are known to frequent open wet areas near forests on Kaua'i and forage near towns and agricultural fields.

4.6.2 Potential Impacts and Mitigation Measures

Because the existing site is already highly urbanized, no significant impact to fauna resources are expected since the proposed uses will be the same. The increase in open space and landscaping may improve conditions for some avian species such as the Kōlea which is attracted to open grassy areas and lawns.

Because Newell's shearwaters are known to fly over the area and can be distracted by outdoor lighting, the proposed improvements will minimize potential impacts to these birds by requiring that all new outdoor lighting fixtures be shielded and pointed downwards. Lighting fixtures approved by the International Dark-Sky Association (IDA) are recommended and can be found at their website: www.darksky.org/lighting.

The following guidelines will be followed in selecting and designing any outdoor lighting:

- All outdoor lights including parking lot lights, landscaping, security, path and deck lights should be fully shielded, full cutoff luminaries.
- Complete avoidance of all outdoor up-lighting for any purpose.
- Avoidance of tree-mounted lights unless they are fully shielded and pointing down towards the ground or shining into dense foliage. Ensure compliance over time.
- Complete avoidance of up-lighting and unshielded lighting in water features such as fountains and ponds.

No special mitigation measures are recommended for the Hawaiian Hoary Bat since none of the proposed improvements are expected to impact them. They are already found in the existing environment and none of the proposed changes are expected to significantly affect their use of the area.

5.0 ASSESSMENT OF EXISTING HUMAN ENVIRONMENT, POTENTIAL IMPACTS, AND MITIGATION MEASURES

This section describes the existing conditions of the human environment, potential impacts of the proposed Līhu'e Civic Center Site Improvements and mitigation measures proposed to minimize any impacts.

5.1 ARCHAEOLOGICAL, CULTURAL AND HISTORIC RESOURCES

5.1.1 Existing Conditions

Līhu'e is located on the southeastern side of Kaua'i in the ahupua'a of Kalapakī. It was established in 1825 by Governor Kaikio'ewa, who was the first governor of Kaua'i under Kamehameha. According to Wichman (1998), he named this area, Līhu'e, in memory of his earlier home on O'ahu. The name, Līhu'e, was unknown on the island before then. The ancient name for this area was Kala'iamea, "calm reddish brown place."

The governor found the area's soils and rainfall suitable for growing sugarcane, and eventually much of Līhu'e was planted with sugarcane fields. By the early 1900s, Līhu'e Plantation and Grove Farm Plantation had established Līhu'e as a profitable sugarcane production area. The Līhu'e Mill was one of the longest sugar mills in service in the state. It started operations in 1849 and finally shut its doors in 2000. Nāwiliwili Harbor became the main port for shipping on the island and the Historic County Building was built in 1912, literally cementing Līhu'e as the civic seat of the island. It remains the longest operational county building in the State of Hawai'i.

Since then, the surroundings have changed dramatically, undergoing a series of transformations as a community and civic center have developed around it.

Despite the changes over time, there are still several historic buildings and a historic district within and near the Līhu'e Civic Center. Within the project site, the Līhu'e Civic Center Historic District is listed on the State and National Registers of Historic Places (Site Number 30-11-9351). It comprises all but the State Office Building on the eastern block of the project site. The Historic County Building, built in 1912, and the County Annex Building, built in the 1930s, are included within this Historic District. The Historic District also encompasses the County Lawn and its double row of royal palms as well as the State Courthouse.

Also listed on the State and National Registers but is not located within the project site is the Kaua'i Museum's Albert Spencer Wilcox Building (Site Number 30-11-9344). It was added to the two lists in 1979. The Līhu'e Post Office, located across Rice Street from the Civic Center, was included on the National Register in 1989 and

is listed as Site Number 30-11-9342. The historic properties are identified in yellow in Figure 1 and Figure 5.

No archaeological surveys were performed on the site as the project area is located in an existing urbanized area. The entire site has been previously disturbed during historic and modern ground-altering activity. This includes agricultural activity that once occurred on the site as well as the construction of previous residential structures, and more modern retail and office buildings including the existing Civic Center.

5.1.2 Potential Impacts and Mitigation Measures

Major site work including grading and excavation will be necessary to construct the underground parking lots. However, the rest of the proposed improvements will require minor grading only. Although the project is located in an existing urbanized area, it is possible that historic remains may be found during groundwork. Should any historic remains, such as artifacts, burials, concentrations of shell or charcoal be encountered during construction, all work in the immediate vicinity of the find will cease and the find will be protected from additional disturbance. The State Historic Preservation Division, Kaua'i Section will also be contacted immediately for appropriate action and mitigation in accordance with Chapter 6E, Hawai'i Revised Statutes, as necessary. Furthermore, the County will comply with all federal, state, and county laws regarding stormwater runoff and erosion control during the grading and excavation phases of the project and minimize any potential impact to historic resources by using best management practices such as erecting protective barriers and diverting any runoff away from these resources. The County will also design and construct the underground parking structures so as not to impact the foundations of the historic buildings.

The proposed changes within the Līhu'e Civic Center Historic District are minor and are not expected to negatively impact the historic or cultural resources. No changes are proposed for any of the historic buildings. The improvements involve mainly landscaping, parking and pathway improvements. The proposed site improvements are intended to enhance the historic resources in and around the area by restoring historic elements and providing better pedestrian access, landscaping, and signage. For example, one of the proposed master plan recommendations is to replace the missing royal palms in front of the Historic County Building. Care will also be taken during the design and installation of the site improvements that no new plantings will obstruct the immediate visual vista of the primary façades of the historically listed buildings.

The proposed Līhu'e Civic Center Site Improvements are not expected to adversely impact to cultural resources. The improvements will not affect Native Hawaiian gathering rights or traditional practices. The improvements are intended to preserve and accentuate the historic buildings, enhance cultural awareness of Līhu'e's history and provide the community with the opportunity to engage in the Civic Center area.

5.2 NOISE

5.2.1 Existing Conditions

The predominant sources of noise in the vicinity of the property stem from traffic traveling along the surrounding streets and the neighboring commercial uses to the south and north of the project site. Other sources of noise include aircraft flyovers due to the site's proximity to the Līhu'e Airport and natural sources, such as wind and rain.

5.2.2 Potential Impacts and Mitigation Measures

As the Līhu'e Civic Center Site Improvements Master Plan does not change its current use, no long-term noise impacts are expected due to the proposed improvements. The plan does include the closure of 'Eiwa Street which would actually reduce traffic noise within the center of the Civic Center. The proposed increase in vegetation and open space in and around the Civic Center would also help buffer traffic noise heard within the Civic Center.

During project construction phases, there will likely be noise impacts associated with the operation of construction machinery, excavation and grading equipment and material transport vehicles. However, the impact will be temporary. Noise levels from typical construction equipment range between 70 and 95 decibels (dBA). To mitigate construction noise levels, the County of Kaua'i will work with the contractor to ensure adherence with State Department of Health (DOH) regulations, use of proper equipment and regular vehicle maintenance. Equipment mufflers or other noise attenuating equipment may also be employed as required. All construction activities will be limited to daylight work hours. In the event that construction noise levels are expected to exceed permissible levels, a permit would be obtained from the DOH. Time restrictions on when noise levels are allowed to exceed permissible levels are typically included in the permit. It is expected that after the proposed construction is complete, ongoing generating activities will be similar to existing conditions.

5.3 AIR QUALITY

5.3.1 Existing Conditions

Regional and local climate, together with the amount and type of activity generally determine the air quality of a given location. At the project site, winds are predominantly trade winds. During winter, storms may bring Kona winds for brief periods. When the trade winds or Kona winds are weak or absent, landbreeze-seabreeze circulations may develop.

Generally, air quality in the project vicinity is good and meets state and federal air quality standards. There are no point sources of airborne emission within proximity of the project site. Pollutants that exist may be attributable to a variety of sources,

including traffic traversing neighboring roadways. Emissions from such sources are intermittent and minimal and are quickly dispersed by prevailing trade winds.

5.3.2 Potential Impacts and Mitigation Measures

Emission derived from operation of construction equipment and other vehicles involved in construction activities may temporarily affect the ambient air quality in the immediate vicinity. However, these effects will be minimized through proper maintenance of construction equipment and vehicles. In addition, there may be a temporary adverse impact on air quality attributable to dust generated during project construction, particularly earthmoving activity, including excavating, trenching and filling.

It is anticipated that no State of Federal air quality standards will be violated during or after the creation of the proposed improvements. A dust control plan will be implemented during all phases of development. All construction activities will comply with the provisions of Chapter 11-60.1-33, Hawai'i Administrative Rules on fugitive dust. Measures to control dust during various phases of construction will include:

- Planning phases of construction to minimize the amount of dust-generating materials and activities, centralizing onsite vehicular traffic routes, and locating potential dust-generating equipment in areas of least impact;
- Providing an adequate water source at the site prior to start-up construction activities;
- Landscaping and rapid covering of bare areas, including slopes, starting from the initial grading phase;
- Minimizing dust from unpaved areas or roads during grading activities;
- Providing adequate dust control measures during weekends, after hours and before daily start-up of construction activities; and
- Controlling dust from debris by adequately covering it when hauled away from the project site.

After construction, the proposed site improvements are not expected negatively impact air quality. In fact, the increase in landscaping and plant material would probably improve air quality by increasing absorption of carbon dioxide and filtering particles generated by the traffic on the surrounding roadways.

5.4 VISUAL RESOURCES

5.4.1 Existing Conditions

The existing site and surrounding areas are heavily urbanized. They are comprised of commercial businesses, public and civic uses, and residential communities. Distant views of the Hā'upu Range to the south and Wai'ale'ale to the west can be seen from the Civic Center.

According to the Kaua'i General Plan Heritage Resource Map, there are scenic roadway corridors along Kaumuali'i and Kapule Highways (Figure 9). However, neither is visible from the project site and will not be affected by the proposed site improvements.

5.4.2 Potential Impacts and Mitigation Measures

The proposed Līhu'e Civic Center Site Improvements will be compatible with the existing visual environment and are intended to enhance the scenic qualities of the area. The proposed improvements do not involve construction of any building or vertical above grade structures that will obstruct view planes or visual resources. If the parking structures are pursued, they will be located underground. All other parking lots will be at grade. The surrounding commercial businesses, public, civic and residential uses, as well as distant mountain views will still be visible from the project site. Proposed street trees along commercial areas will be trimmed so their lowest branches are roughly twelve to fifteen feet high to avoid blocking storefronts and signs.

5.5 SOCIO-ECONOMIC CHARACTERISTICS

5.5.1 Community Character

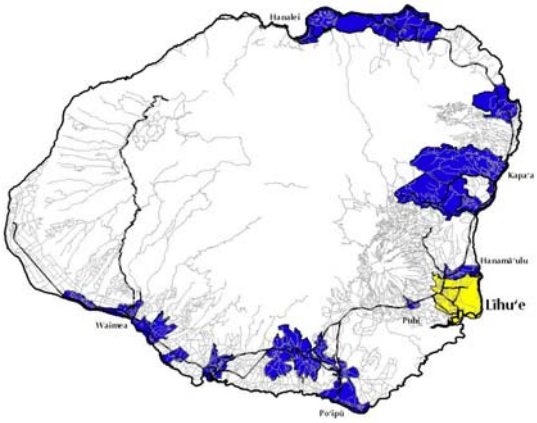
5.5.1.1 Existing Conditions

Although Līhu'e is the seat of government, the center of transportation, and home to most of the commercial business establishments on Kaua'i, it has retained a small town feel. There are several residential communities in and around the Civic Center with schools and parks nearby. Most buildings are still one to two stories and distant views of the surrounding mountains are prevalent.

The project site itself feels unfinished. Parking lots dominate the view of the western block and 'Eiwa Street splits the Civic Center into two separate pieces. There are no clear pedestrian walkways and many people rather drive than walk within the Civic Center. Besides the County Lawn, landscaping is minimal and the area is uncomfortable due to the heat reflecting off the asphalt.

5.5.1.2 Potential Impacts and Mitigation Measures

The proposed site improvements will enhance the character of the Civic Center through landscape and pedestrian improvements at the town's core. Much of the parking will be located in underground parking structures so that more open space can be provided for public enjoyment. Cars will no longer dominate the Civic Center as they do now. The improvements are intended to revitalize the Civic Center and create a landscaped campus-like gathering place for the community.



5.5.2 Population

5.5.2.1 Existing Conditions

According to the 2000 United States Census, the population of Kaua'i County was 58,463 persons. For the Līhu'e Census Designated Place (Līhu'e CDP, highlighted to the left), the population was 5,674, or roughly ten percent of the resident population of the island.

The median age of Līhu'e residents in 2000 was 44 while Kaua'i's as a whole was 38. Within the immediate area bounded by Rice Street, Kūhiō Highway, Ahukini Road and Kapule Highway (the town core), it was even higher at 47 years of age. Nearly a quarter of the Līhu'e CDP's population was over 65 (22.4 percent) and nearly another quarter is 17 years of age or younger (22.8 percent).

Of the 2,178 households within the Līhu'e CDP, 30.4 percent (663 households) had children under the age of 18 years and nearly 40 percent (863 households) had individuals 65 years or older. 16.1 percent of households consisted of individuals living alone who were over the age of 65 (350 households). Within the Līhu'e town core, the percentage of individuals over the age of 65 living alone is even higher at 17.4 percent (69 households). In comparison, only 7.7 percent of Kaua'i County households consisted of individuals over the age of 65 living alone and 27.7 percent of households had individuals over the age of 65. This indicates that there are proportionally more Līhu'e households with elderly persons than Kaua'i as a whole. There are also quite a few Līhu'e households with children, however, proportionally less than the Kaua'i average for households.

Government workers represented 18.3 percent of all civilian employed residents in the Līhu'e CDP and they comprised an even higher proportion within the town core at 24.2 percent. This indicates that a relatively high number of government workers lived near the Civic Center in 2000.

5.5.2.2 Potential Impacts and Mitigation Measures

The proposed Līhu'e Civic Center site improvements will not have an impact on resident population growth since the land uses within the project site will remain the same. The proposed improvements will, however, improve pedestrian accessibility and safety and encourage people to use the outdoor areas of the Civic Center. This could have a positive impact on those who cannot drive such as seniors and children. Seniors over the age of 65 and children under 18 comprise nearly half the resident population in the Līhu'e CDP and will benefit from the proposed improvements since walking in and around the Civic Center will be easier and safer. The proposed site improvements will also benefit government workers and visitors to the Civic

Center by providing comfortable outdoor places to sit and gather for lunch and increase the opportunities to meet informally as they walk between buildings. Improved sidewalks and transit and bicycle facilities may also encourage people to use different modes of transportation to access the Civic Center and get more exercise. The proposed site improvements could improve the quality of life for those who use the Civic Center.

5.5.3 Economy

5.5.3.1 Existing Conditions

Līhu'e is the second largest town in Kaua'i and is the government, business and transportation hub of the island. There are roughly 800 government employees working in Līhu'e and about half of Kaua'i's businesses have a Līhu'e zip code (96766). The nearby port at Nāwiliwili Harbor and the Līhu'e Airport indicate that most goods and people coming to or leaving Kaua'i must pass through Līhu'e. However, in certain portions of Līhu'e, such as along Rice Street, there are intermittent vacant commercial spaces and small businesses frequently turn over.

Although Hurricane 'Iniki brought soaring unemployment to Kaua'i during the 1990s, the unemployment rate has steadily declined and has caught up and surpassed the State's current low rate of 2.4 percent. Kaua'i's unemployment rate was 2.2 percent in April 2007.

5.5.3.2 Potential Impacts and Mitigation Measures

The proposed Līhu'e Civic Center site improvements will become an integral part of the Līhu'e and indirectly provide economic benefits through the potential draw of people to the area and the encouragement of reinvestment in the surrounding areas. The improvements will not have a significant direct impact on the economy; however, they will benefit the economy through creation of construction and landscaping related job opportunities and construction expenditures. Installation of the improvements will generate additional tax revenue to the State through general excise taxes on development expenses. However, the proposed site improvements will not generate significant direct tax revenues for the County of Kaua'i since County revenues are primarily limited to tax revenues on privately-owned property and improvements.

5.6 INFRASTRUCTURE

5.6.1 Roadways and Traffic

5.6.1.1 Existing Conditions

Roadway access to the Līhu'e Civic Center is by Kūhiō and Kaumuali'i Highways from the north and west, respectively. Access from the southeast is by Rice Street, which also serves as the main road through Līhu'e Town. Kūhiō and Kaumuali'i

Highways meet at the signalized intersection with Rice Street. Kaumuali'i technically terminates at the Rice Street and Halekō Road intersection. These roadways, together with Hardy Street on the north and 'Umi Street on the east, form the borders of the project area. 'Eiwa Street bisects the Civic Center into an east block that includes the Historic County Building and State buildings, and a west block with the renovated County buildings, Hawaiian Telcom, and Big Save.

Kūhiō Highway is a four-lane highway north of Rice Street. Kaumuali'i Highway is a two-lane highway south of the intersection with Rice Street. The two highways provide regional north-south access to, from and through Līhu'e from the rest of the island. There is no on-street parking permitted on either highway within the project area. At the time of this report, the State Department of Transportation (DOT) was in the design stage to widen Kaumuali'i Highway to four lanes between Līhu'e and Puhi. Construction is estimated to commence in 2008. Kūhiō Highway has a narrow sidewalk on the west side of the highway that terminates at the intersection of Rice Hardy Street. On the east side, the sidewalk is narrow, but the existing landscaping provides some buffer for pedestrian from the passing cars.

Rice Street was recently widened to a four-lane roadway providing east-west access on the southern boundary of the Civic Center. Between Halekō Road and 'Umi Street, there are a total of nine parallel parking stalls in the eastbound direction. Six of them are inset from the curb and do not block traffic flow. However, the three parallel stalls between 'Eiwa Street and 'Umi Street do block one lane of traffic when parking is allowed. In the westbound direction, there are six on-street parallel parking stalls west of 'Eiwa Street. Street parking is permitted during off-peak traffic periods effectively limiting Rice Street to two lanes, one lane in each direction. Peak parking bans are in effect from 7:00 to 9:00 A.M. and from 3:00 to 5:00 P.M. During the parking bans, traffic flows in all four lanes- two lanes of travel in each direction.

The popular crosswalk in front of the Līhu'e Post Office was removed several years ago and replacement crosswalks were added by 'Eiwa Street and Halekō Road. Neither of these added crosswalks are easy to cross. The topography at Halekō Road limits driver and pedestrian sight distances and the 'Eiwa Street intersection has complicated vehicle turning movements due to the offset intersections and multiple driveways. Although unsafe, many people are known to jaywalk where the original crosswalk was located near Kele Street in front of the post office.

Elderly pedestrian jaywalking across Rice Street near Kele Street and the Līhu'e Post Office

Plastic traffic delineators were placed on the center line of Rice Street between 'Eiwa Street

and Halekō Street in early October 2003. The delineators block left turns from Rice Street into the County driveway and Kele Street. On the portion of Rice Street between Kūhiō Highway and ʻEiwa Street, the sidewalks on the north side of the street are very narrow and the kou trees located in the planting strip between the parking lot and roadway crowd pedestrians toward the travel lanes. The sidewalks on the south side of Rice Street vary in width. There are no sidewalks or curbs along portions of the Halekō Shops and a narrow sidewalk in front of the Isenberg Memorial and Bank of Hawaiʻi. Further east, the sidewalk opens up in front of the Post Office and remains relatively wide (over ten feet) up to and beyond ʻUmi Street. However, portions of the sidewalks cross-sections are uneven and sloping.

View of Hardy Street near the bus stop. There are no curbs or sidewalks on the Civic Center side of the street. The area tends to puddle when it rains.

Hardy Street is a two-lane roadway that provides east-west access on the north side of the Civic Center. On-street parking is permitted on both sides of the street. There is also a bus stop shelter on the Civic Center side of Hardy Street. Hardy Street has sidewalks on the north side but none on the Civic Center side of the street. Drainage is poor on the south side of Hardy Street since there are no curbs or gutters. The area often puddles when it rains, particularly near the bus stop.

ʻUmi Street is a two-lane road that provides local north-south access between Rice Street and Hardy Street. Parallel parking is permitted on both sides of ʻUmi Street but there are no sidewalks on the Civic Center side of ʻUmi Street. There are sidewalks only on the eastern side of the road. Due to the bend in Hardy Street, the intersection of ʻUmi Street and Hardy Street has wide distances between curbs. Pedestrian crossing is not recommended except on the north leg of ʻUmi Street.

ʻEiwa Street is a two-lane road that cuts through the center of the Civic Center. It has a 60 foot right-of-way and the entire width of the roadway is paved with asphalt. There are no sidewalks; only a painted pedestrian route with plastic delineators on the eastern side of the street. This was installed as ADA improvements in 2001 but is not a comfortable pedestrian environment. On the western side of the street, parallel parking runs almost the entire length. There are no curbs on the western side. On the eastern side there are curbs around the planting areas but no sidewalks. The street narrows to 40 feet near the intersection of Rice Street and forms an offset intersection with Waʻa Street. On the north end, ʻEiwa does not line up with ʻAkahi or ʻElua Streets forming another set of offset intersections. These offset intersections

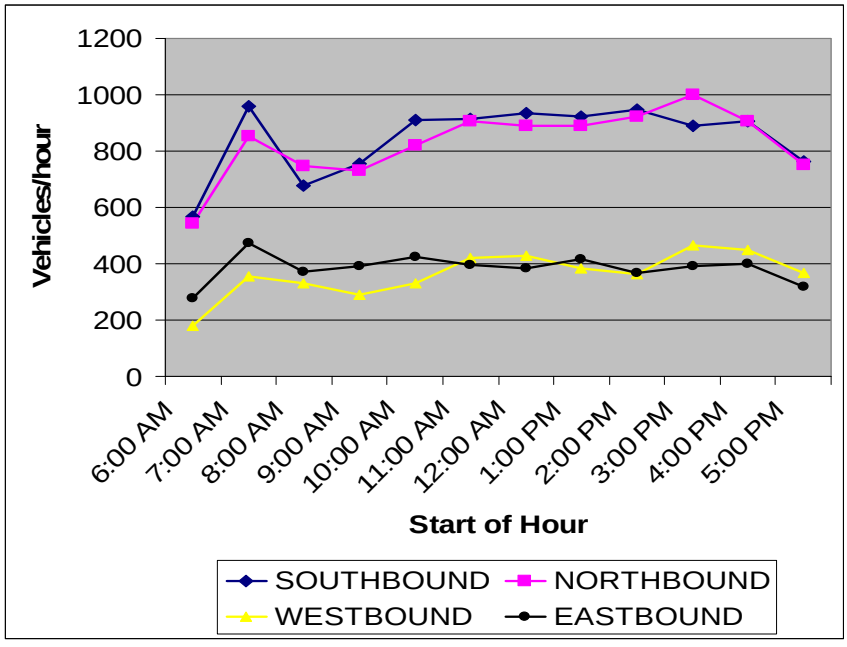
complicate turning movements for drivers since oncoming cars are entering the area from multiple directions.

5.6.1.2 Existing Traffic Conditions

M&E Pacific, Inc. prepared a traffic study for the proposed site improvements and it is attached its entirety as Appendix A. Existing traffic conditions were included in their analysis. Traffic counts were taken at all major and most minor intersections and driveways around the project site in late September to mid-October 2003. The study analyzed existing traffic as well as ten-year projections to the year 2015. It projected traffic counts both with and without the proposed master plan improvements and provided recommendations to accommodate vehicular traffic while balancing pedestrian safety and community concerns.

According to the traffic study, the morning peak hour of Civic Center traffic occurs between 7:15 and 8:15 AM and the afternoon peak hour occurs between 4:00 and 5:00 PM. The highest volumes occurred between 7:30-7:45 AM and 4:30-4:45 PM, which coincide with the County's official workday start and finish times.

There are other portions of the day when traffic volumes are relatively high within the Civic Center. The following graphic shows the hourly traffic counts throughout the day as measured by the State of Hawai'i Department of Transportation (DOT) in 2001 and summarized by M&E Pacific.



Hourly Traffic on Kūhiō/Kaumuali'i Highway and Rice Street (M&E Pacific, State DOT)

Traffic tends to increase around 10:00 AM and remains relatively steady through the afternoon peak hour. However, the peak hours are used in the traffic study as the basis of analysis since they represent the worst case scenarios.

As an aside, because traffic is relatively steady during the day from about 10:00 AM till 5:00 PM on Rice Street, the County should consider revising the hours of the parking ban on Rice Street. This decision should be weighed against the impact of losing those stalls to nearby businesses that may need them for customer parking. They should consider the businesses' hours of operation and apply the parking ban only to those stalls that block traffic lanes. The six stalls in front of the Post Office and First Hawaiian Bank that do not block any travel lanes should not be included in the parking ban.

Level of Service (LOS)

The Transportation Research Board (TRB) has developed procedures to quantify the quality of traffic flow on roadways based on a comparison of the roadway's capacity to traffic volume. This measure is called level of service (LOS) and is graded on a scale from A to F. LOS A is the best traffic conditions with average delays less than 10 seconds for unsignalized intersections and 20 seconds for signalized intersections. F is the worst with average delays longer than 50 seconds for unsignalized intersections and 80 seconds for signalized intersections. LOS can be assigned to any movement through a signalized or unsignalized intersection, including turning movements. However, an overall intersection LOS is only given to signalized intersections.

The existing LOS at the intersections around the project site and key movements through the intersections are summarized in the table below. The movements with relatively long delays during the peak hours of traffic (LOS E or F) are italicized.

Table 5: Existing Traffic Conditions

		AM PEAK		PM PEAK	
	APPROACH*	**LOS**	**Delay**	**LOS**	**Delay**
SIGNALIZED INTERSECTION ANALYSES					
Rice Street/Kūhiō Highway		**B**	**13.9**	**B**	**17.3**
	Rice St WB	D	36.9	D	45.7
	Kūhiō Highway SB	A	8.6	A	9.4
	Kaumuali'i Hwy NB	B	13.4	B	15.3
Rice Street/'Umi Street		**B**	**11.2**	**B**	**12.8**
	Rice St EB	A	9.4	A	9.5
	Rice St WB	A	8.4	A	8.8
	'Umi St NB	B	18.1	C	21.4
	'Umi St SB	C	24.6	C	24.7
UNSIGNALIZED INTERSECTION ANALYSES					
Rice Street/Halekō Road					
	Halekō Rd NB right	***E***	***39.6***	***E***	***38.1***
	Rice St WB left	B	10.5	C	15.3
Rice Street/'Eiwa Street					
	'Eiwa St SB	C	17.3	C	24.3
	'Eiwa St SB right	B	12.8	C	16.6
	'Eiwa St SB left	***E***	***45.7***	***F***	***90.1***
	Rice St EB left	B	10.1	B	11.8
Rice Street/Kele Street					
	Kele St NB	C	22.2	***F***	***78.3***
	Rice St WB left	A	9.8	A	9.8

		AM PEAK		PM PEAK	
	APPROACH*	**LOS**	**Delay**	**LOS**	**Delay**
Hardy Street/Kūhiō Highway					
	Hardy St WB	***F***	***100+***	***F***	***100+***
	Hardy St WB right	C	16.9	D	31.7
	Hardy St WB left	***F***	***100+***	***F***	***100+***
	Kūhiō Hwy SB left	C	15.1	B	14.4
Hardy Street/'Akahi Street					
	'Akahi St SB	B	10.0	B	10.8
	Hardy St EB left	A	8.1	A	8.2
Hardy Street/'Eiwa Street					
	'Eiwa St NB	B	14.5	B	13.9
	Hardy St WB left	A	9.8	A	8.9
Hardy Street/'Umi Street					
	'Umi St NB	***F***	***54.7***	***E***	***45.4***
	'Umi St NB right	B	11.1	B	10.3
	'Umi St NB left & through	***F***	***78.2***	***F***	***54.4***
	'Umi St SB	C	25.0	D	25.6
	Hardy St EB left	A	7.8	A	8.0
	Hardy St WB left	A	8.5	A	8.2
CIVIC CENTER DRIVEWAYS					
Rice Street/County Driveway					
	County Driveway SB	B	11.0	B	13.0
	Rice St EB left (eliminated 10/9/03)	A	9.6	B	10.4
Hardy Street/County-Big Save Driveway					
	County-Big Save Driveway NB	C	16.2	C	19.0
	Hardy St WB left	A	8.9	A	8.4
'Umi Street/County-State Driveway					
	Driveway EB	B	10.5	B	10.1

*Abbreviations: NB = Northbound; SB = Southbound; WB = Westbound; EB = Eastbound

Several existing left turn movements have LOS F indicating long delays and the possible need for mitigation. These movements include southbound 'Eiwa Street onto Rice Street, westbound Hardy Street onto Kūhiō Highway, and northbound 'Umi Street onto Hardy Street. The left turn from Hardy Street onto Kūhiō Highway is particularly difficult to make and is characterized by delays of over 100 seconds (1.7 minutes). The left turns from 'Umi Street onto Hardy Street are made into congested local traffic. Drivers on Hardy Street often let 'Umi Street drivers make the left turn so their wait time may not be as long as the calculations indicate.

A LOS F not only means long delays but could also indicate a hazardous traffic situation as drivers become impatient, take chances and make turns through smaller than acceptable gaps in the oncoming traffic stream. This is the case with the left turn from Hardy Street onto Kūhiō Highway. To avoid this difficult left, drivers may be taking alternate routes such as 'Eiwa Street in order to get to a signalized intersection such as Rice Street where left turns could be more safely made.

The Halekō Road right turn movement onto Rice Street shows LOS E for both peak periods. This would indicate current minimally acceptable conditions that could require mitigation in the future as traffic on Rice Street increases.

LOS alone is not sufficient to evaluate the efficiency of left turn movements from major streets, especially when the movement is made from a shared traffic lane. As an example, traffic backups often occur on Rice Street due to vehicles making left turns into 'Eiwa Street and various businesses' driveways. The LOS for the left turn movement from Rice Street into Halekō Road were B and C, which would normally be considered acceptable but does not indicate the traffic queuing that was taking place.

Other Traffic Trends

In addition to the traffic study, the State DOT-Highways takes biannual traffic counts at the Kūhiō Highway and Rice Street intersection. M&E Pacific, Inc. also tabulated this information and found that between 1991 and 2003 a proportionate amount of traffic seemed to be shifting from Rice Street to Kūhiō Highway indicating that traffic may be taking alternate east-west routes from Kūhiō/Kaumuali'i Highways such as Ahukini Road or Nāwiliwili Road rather than Rice Street (see Table 6). According to the State DOT-Highways Division Kaua'i District Office, the reductions in traffic volumes on Rice Street between 1993 and 1999 were probably due to the after effects of Hurricane 'Iniki while the drop in volume between 1999 and 2001 is probably due to the reconfigured intersection of Kaumuali'i Highway, Kūhiō Highway, and Rice Street. Prior to 1999, the traffic flow moved directly between Kaumuali'i Highway and Rice Street with Kūhiō Highway intersecting the roads at a T-intersection. Then in 1999, the DOT changed the traffic flow so that Rice Street T's into Kaumuali'i/Kūhiō Highways.

The DOT currently has plans to do similar improvements to the intersection of Rice Street and Kapule Highway further east of the project site. It is projected that this may have a similar effect of further reducing daily traffic on Rice Street. At the time of this report, the DOT was in the design phase for this project. The DOT also has plans to widen Kaumuali'i Highway south of Rice Street to four lanes. They are also in the design phase for this project.

Table 6: Daily Traffic Volumes at Kūhiō Highway and Rice Street

	DAILY TRAFFIC VOLUMES		ANNUAL % GROWTH FROM 1991	
YEAR	KŪHIŌ HIGHWAY	RICE STREET	KŪHIŌ HIGHWAY	RICE STREET
OCT 91	19833	15146	--	--
OCT 93	20726	15135	2.3	0.0
JUNE 95	22084	13087	2.8	-3.4
JULY 97	21324	13185	1.3	-2.2
AUG 99	21956	12871	1.3	-1.9
OCT 01	24512	10763	2.4	-2.9
AUG 03	24919	11613	2.0	-2.3
Source: M&E Pacific, Inc., State DOT-Highways				

5.6.1.3 Potential Impacts and Mitigation Measures

The proposed improvements are not expected to generate additional traffic since the uses will remain the same. However, the proposed improvements will shift traffic patterns due to the relocation of two County driveways, new internal circulation patterns, the location of the proposed parking structures, and the elimination of 'Eiwa Street.

The following sections describe recommendations from the traffic study and the proposed designs incorporated into the master plan. It includes the rationale the traffic engineers used for the proposed improvements which attempt to balance vehicle, pedestrian and community concerns.

Rice Street

The traffic volumes forecasted for the street do not allow Rice Street to be narrowed back to a two-lane road with center turn lane. The four-lane design will be sufficient for projected traffic, but permitting of on-street parking during the day would need to be more closely examined.

The master plan proposes to relocate the County driveway westward to align it directly across Kele Street. Traffic signals are barely warranted with the forecast traffic volumes but pedestrian crossings would become safer with traffic signals.

The left eastbound lane of Rice Street at 'Umi Street should be converted into an exclusive left turn lane through restriping. A three-phase signal with a leading left turn and through phase for eastbound traffic should be created. It may require installation of new traffic signals to provide the mastarms required for leading turn phases. It would also eliminate the onstreet parking in the right eastbound lane near this intersection.

The Rice Street/'Eiwa Street intersection should be eliminated because if left unchanged, the only way to mitigate projected traffic problems at this intersection would be to install traffic signals. A new signal would cause a major change in the traffic patterns and would be very close to the signals at Kele and 'Umi Streets which may not desirable.

Halekō Road

Projected traffic would require widening Halekō Road to four lanes. However, due to the historic importance of Halekō Road, community members have voiced opposition to widening it four lanes. The need to widen Halekō Road is also minimized by the State DOT's plans to widen Kaumuali'i Highway to four lanes in this area. If Halekō Road is not widened as proposed in the master plan, consideration should be given to making Halekō Road right turn in, right turn out at Rice Street to minimize the traffic growth on Halekō Road and to avoid traffic signals. Eastbound traffic would be diverted to Kaumuali'i Highway. The left turn from Rice Street onto Kaumuali'i Highway would have to be made into two lanes to accommodate the additional traffic. This widening should be coordinated with the planned widening of Kaumuali'i Highway to four lanes. If left turns are permitted from Rice Street on to Halekō Road, traffic signals will be required which could cause traffic operational problems on Rice Street. However, whether the signal is needed or the left turn should be eliminated can be evaluated at a future date by the State DOT-Kaua'i District Office and the County when traffic at this intersection becomes problematic.

Rice Street/Kūhiō Highway/Kaumuali'i Highway Intersection

The traffic signal timing at this intersection should be adjusted as growth occurs. If Halekō Road is not widened to four lanes, a second left-turn lane from Rice Street should be added. This should be coordinated with the State DOT and their plans to widen Kaumuali'i Highway west of Rice Street.

Hardy Street

Hardy Street should be able to operate as a two-lane roadway with the projected traffic growth, although it could operate at LOS D or worse during some time periods.

Kūhiō Highway/Hardy Street Intersection

The Kūhiō Highway/Hardy Street intersection should be signalized. Even without the closure of 'Eiwa Street, traffic signals are warranted to meet the existing latent demand at this intersection. Existing conditions for the left turn movement from Hardy Street westbound onto Kūhiō Highway are already operating at LOS F in both peak periods. Based on the pattern of traffic volumes, it is believed many drivers are using 'Eiwa Street as a shortcut to make a right turn onto Rice Street and make a left turn onto Kaumuali'i Highway rather than make the left at Hardy Street. The traffic study recommends signalizing the intersection with a leading phase for the Kūhiō

Highway southbound left turn movement. The intersection is forecast to operate at LOS B in the morning peak and C in the afternoon peak with signalization.

Hardy Street/'Akahi Street/County Driveway Intersection

The proposed Hardy Street/'Akahi Street/County Driveway intersection shifts the existing access at 'Eiwa Street so that lines up directly with 'Akahi Street. The second County driveway closer to Kūhiō Highway will be maintained so the total number of access points on Hardy Street remains the same. The new Hardy Street/'Akahi Street/County Driveway intersection should be signalized when warranted in the future. Traffic signals are minimally warranted with the forecast traffic volumes but signals will make left turns and pedestrian crossings easier. The current two-lane roadway design of Hardy Street would be sufficient. However, the addition of left-turn queue lanes on the Hardy Street approaches would allow traffic to safely pass cars queuing to turn left.

As a side note, if 'Eiwa Street were to remain in this area, the only way to mitigate forecasted traffic conditions would be to signalize the intersection at Hardy Street. With the proposed closure, the "zigzag" movement currently required to cross Hardy Street from 'Akahi and 'Elua Streets will be eliminated.

Hardy Street/'Umi Street Intersection

The northbound approach of 'Umi Street is currently operating at level of service F in the A.M. peak and E in the P.M. peak. The master plan proposes a traffic roundabout as one means to mitigate the problem. Traffic roundabouts were thought to be a better solution than traffic signals due to the unique geometry of this intersection. As an alternative, if traffic signals were installed to mitigate projected traffic, it would probably require split phasing which would reduce the green time for Hardy Street traffic and potentially back traffic up on Hardy Street during the green time allocated to 'Umi Street cross traffic. There is also sufficient land to install a traffic roundabout. Additionally, a traffic roundabout would be less expensive to install and easier to maintain than a traffic signal. A four-way stop would not be feasible due to the much higher traffic volumes on the east approach.

The analysis for traffic roundabouts does not calculate a level of service value due to the limited US experience with roundabouts. The Highway Capacity Software (HCS) methodology for traffic roundabouts calculates only a volume to capacity (v/c) ratio.[1] The roundabout's eastbound approach on Hardy Street is forecast to have the highest v/c ratio of the four approaches, ranging from 0.61 in the morning peak to 0.70 in the afternoon.

[1] When v/c ratios exceed 1.0, this means the volume of traffic is exceeding the capacity of the design. If v/c ratios are less than 1.0, then the proposed design is able to accommodated projected traffic.

'Umi Street

Large traffic increases are not forecast for 'Umi Street. Therefore, major traffic improvements are not required. The current two-lane roadway design is sufficient. Assuming there are no major land use changes for the State properties on 'Umi Street, including the vacant Police Building, the current roadway design is sufficient. Major changes by the State would require re-examination of street design.

Table 7 summarizes the projected traffic conditions without the proposed master plan improvements. This provides a baseline for 2015 traffic, showing what future traffic conditions would be like if no improvements are constructed. Table 8 summarizes the projected traffic conditions with the proposed master plan improvements.

Other Factors

Improved sidewalks, transit and bicycle facilities may also encourage people to use different modes of transportation to access the Civic Center. This would reduce the number of driving trips, particularly the short trips within the Civic Center as well as the need for vehicle parking space.

Table 7: Projected Traffic Conditions without the Proposed Improvements (Ambient Scenario 1)

		AM PEAK		PM PEAK	
	APPROACH*	**LOS**	**Delay**	**LOS**	**Delay**
SIGNALIZED INTERSECTION ANALYSES					
Rice Street/Kūhiō Highway		**B**	**17.7**	**C**	**24.0**
	Rice St WB	D	42.7	D	41.4
	Kūhiō Highway SB	B	13.8	B	17.2
	Kūhiō Highway SB left	D	36.8	D	48.6
	Kaumualiʻi Hwy NB	B	14.7	C	24.6
Rice Street/ʻUmi Street		**B**	**12.2**	**B**	**14.2**
	Rice St EB	B	10.9	B	10.9
	Rice St WB	A	8.8	A	9.5
	ʻUmi St NB	B	18.3	C	24.1
	ʻUmi St SB	C	26.6	C	27.5
UNSIGNALIZED INTERSECTION ANALYSES					
Rice Street/Halekō Road					
	Halekō Rd NB right	***F***	***100+***	***F***	***100+***
	Rice St WB left	B	12.2	D	25.1
Rice Street/Kele Street					
	Rice St WB left	B	10.4	B	10.5
	Kele St NB	D	29.2	***F***	***100+***
Rice Street/ʻEiwa Street					
	ʻEiwa St SB	C	21.5	***E***	***41.1***
	ʻEiwa St SB right	B	14.6	C	22.1
	ʻEiwa St SB left	***F***	***72.8***	***F***	***100+***
	Rice St EB left	B	11.0	B	13.2
Hardy Street/Kūhiō Highway					
	Hardy St WB	***F***	***100+***	***F***	***100+***
	Hardy St WB right	C	21.9	***E***	***49.5***
	Hardy St WB left	***F***	***100+***	***F***	***100+***
	Kūhiō Hwy SB left	C	15.1	C	18.7
Hardy Street/ʻAkahi Street					
	Hardy St EB left	A	8.2	A	8.3
	ʻAkahi St SB	D	29.5	***F***	***57.0***
Hardy Street/ʻEiwa Street					
	ʻEiwa St NB	***F***	***100+***	***F***	***100+***
	Hardy St WB left	B	10.8	A	9.7

		AM PEAK		PM PEAK	
	APPROACH*	**LOS**	**Delay**	**LOS**	**Delay**
Hardy Street/'Umi Street					
	Hardy St EB left	A	8.0	A	8.2
	Hardy St WB left	A	8.9	A	8.5
	'Umi St NB	***F***	***100+***	***F***	***100+***
	'Umi St NB right	B	12.2	B	11.3
	'Umi St NB left	***F***	***100+***	***F***	***100+***
	'Umi St SB	***F***	***96.6***	***E***	***39.3***

*Abbreviations: NB = Northbound; SB = Southbound; WB = Westbound; EB = Eastbound

Table 8: Projected Traffic Conditions with the Proposed Improvements

		AM PEAK		PM PEAK	
	APPROACH*	**LOS**	**Delay**	**LOS**	**Delay**
SIGNALIZED INTERSECTION ANALYSES					
Rice Street/Kūhiō Highway		**C**	**21.4**	**B**	**18.0**
	Rice St WB	D	40.6	C	33.5
	Kūhiō Highway SB	C	20.8	B	17.4
	Kūhiō Highway SB left	***E***	***69.4***	D	51.1
	Kaumualiʻi Hwy NB	B	17.7	B	15.5
Rice Street/Kele Street/County Driveway		**A**	**8.4**	**A**	**9.3**
	Rice St EB	A	8.1	A	7.4
	Rice St WB	A	7.4	A	8.5
	Kele St NB	C	23.3	C	24.7
	County Driveway SB	C	22.7	C	22.9
Rice Street/ʻUmi Street (3-phase signal)		**B**	**19.9**	**C**	**26.4**
	Rice St EB	B	19.1	C	25.2
	Rice S EB left	C	33.9	D	51.9
	Rice St WB	B	14.9	B	17.5
	ʻUmi St NB	C	20.6	C	30.1
	ʻUmi St SB	C	32.2	D	39.9
Hardy Street/Kūhiō Highway		**B**	**15.2**	**C**	**22.3**
	Hardy St WB	C	31.9	C	26.5
	Hardy St WB left	C	28.3	C	25.1
	Kūhiō Hwy NB	B	14.1	C	25.0
	Kūhiō Hwy SB	B	11.6	B	18.2
	Kūhiō Hwy SB left	C	32.2	***E***	***57.5***
Hardy Street/ʻAkahi Street/County Driveway		**B**	**12.1**	**B**	**15.3**
	Hardy St EB	B	11.7	B	10.2
	Hardy St WB	A	8.1	A	7.9
	County Driveway NB	B	18.8	C	29.3
	ʻAkahi St SB	C	20.6	C	25.5
UNSIGNALIZED INTERSECTION ANALYSES					
Rice Street/Halekō Road					
	Halekō Rd NB right	***F***	***51.4***	C	23.2
	Rice St WB left	B	11.1	C	18.6
Hardy Street/ʻUmi Street Roundabout		**Volume to capacity ratios only**			
	Hardy St EB left		0.61		0.70
	Hardy St WB left		0.34		0.45
	ʻUmi St NB		0.43		0.67
	ʻUmi St SB		0.43		0.18
*Abbreviations: NB = Northbound; SB = Southbound; WB = Westbound; EB = Eastbound					

5.6.2 Water

5.6.2.1 Existing Conditions

The subject property is currently served by the County of Kaua'i Department of Water (DOW). The Puhi-Līhu'e-Hanamā'ulu System transmits water via four major main lines. They are the Kokolau Tunnel Main, Puhi Wells Main, Kilohana Wells Main and the Ma'alu Road Main. Water is transmitted through 8-, 12- or 16-inch pipes along Kaumuali'i Highway, Rice Street, Kūhiō Highway, Ahukini Road, Kapule Highway and Nāwiliwili Road. The existing main lines are adequate to handle peak hour demand for the next 20 years; however, there is inadequate capacity for fire flow in the commercial, school and older residential areas of Līhu'e (*Water Plan 2020*, 2001).

5.6.2.2 Potential Impacts and Mitigation Measures

There will be no adverse impact on transmission and distribution systems. Water consumption at the Civic Center is expected to increase due to the irrigation required for an estimated four acres of proposed landscaping and park improvements. However, the County is investigating the possibility of using non-potable or non-drinking water for irrigation. There are two possible alternatives: installation of a rainwater catchment system or connection to nearby non-potable water resources. For the catchment system, rainwater could be collected through gutters on the County buildings and runoff from parking surfaces could be filtered and collected in a storage cistern. The collected water would then be pumped from the cistern to serve the irrigation system. For the non-potable water resources, the County could purchase non-potable water from Grove Farm. Grove Farm currently supplies non-potable water to the State DOT's irrigation system along Ahukini Road and Kapule Highway. If the County is able to use non-potable water for irrigation, then the use of potable water for irrigation could be reduced or potentially avoided if there is enough non-potable supply. If the catchment system is used, other sources of water, either potable or non-potable, may still be needed to supplement the system when there is insufficient rainfall. However, these non-potable alternatives would minimize or eliminate the impact on potable water sources. The County will continue to investigate these alternatives during the engineering and detailed design stages of the project.

Automatic irrigation systems with moisture sensors should also be installed to control the amount of water used for irrigation. The sensors can detect when there is enough moisture in the soil such as after a heavy rainfall and will shut off the irrigation system to avoid overwatering and wasting water. They are able to control the irrigation system with minimal operational intervention.

During construction of the proposed Līhu'e Civic Center Site Improvements, potable water will be required for control of fugitive dust and to establish project

landscaping. This water use will be temporary, however, and is not expected to have a significant impact on water usage.

There are also County of Kaua'i Department of Water (DOW) water mains along 'Eiwa Street, Hardy Street, Rice Street, and 'Umi Street as well as Kūhiō Highway. During the detailed design of the improvements, care will be taken to minimize impact to the DOW system wherever possible. However, where mains or other connections such as water meter service, fire hydrants, etc. are impacted, DPW will coordinate early in the design phase with DOW to appropriately relocate these facilities in order to maintain service and provide fire protection. DPW will submit construction drawings to the DOW Engineering Division for review and approval for any roadway improvements prior to construction. Furthermore, should DOW service be required for any of the improvements, DPW will submit to DOW detailed water demand calculations along with the proposed meter size required for the improvements.

5.6.3 Wastewater

5.6.3.1 Existing Conditions

As a highly urbanized area, Civic Center area proposed for Site Improvements consists of an extensive network of wastewater facilities.

5.6.3.2 Potential Impacts and Mitigation Measures

The proposed site improvements will not require connection to existing wastewater (sewer) facilities. Thus, there should be no increase in demand or impact on wastewater capacity.

There are wastewater mains along Hardy Street, Rice Street, and 'Umi Street. During the detailed design of the Civic Center improvements, care will be taken to minimize impacts to the wastewater system wherever possible. However, where mains or other connections are impacted by the proposed improvements, DPW will relocate these facilities appropriately.[2]

5.6.4 Drainage

5.6.4.1 Existing Conditions

As an existing urbanized area, the Civic Center area contains an extensive storm water drainage system. Within the project area there is a combination of curb and gutter with catch basins drainage systems and swales with drain inlets. Generally, surface runoff sheet flows towards from north to south and east to west over most of the property and drains into inlets throughout the project site. There are curbs,

[2] If any mains need to be relocated, DPW should coordinate these improvements with any upgrades that may be required for the wastewater system in this area based on the findings of the Līhu'e Facility Plan being prepared by M&E Pacific, Inc. for the County DPW Wastewater Management Division.

gutters, and catch basins along Rice Street, Kūhiō Highway, and the very southern ends of 'Umi and 'Eiwa Streets near their respective Rice Street intersections. Along a short stretch of Hardy Street on the north side between Kūhiō Highway and 'Akahi Street, there are curbs and inlets draining into a 30- to 36-inch corrugated metal pipe. Along the south side of Hardy Street, there are asphalt swales with a few drainage inlets. It often puddles along this side of the street when it rains. On 'Eiwa Street, there is an asphalt swale on the western side of the street, which drains into the 18-inch lines in Rice Street. Besides the inlets and catch basins at the corners of Rice and Hardy Streets, there are no drainage facilities along the length of 'Umi Street and ponding sometimes occurs when it rains.

5.6.4.2 Potential Impacts and Mitigation Measures

The proposed plan increases the amount of open space and the amount of pervious surfaces by nearly 2.4 acres. This will decrease the amount of stormwater runoff generated at the site and should therefore reduce the impact to existing drainage systems. If rooftop and parking lot catchment systems are installed, this will further reduce the amount of runoff generated at the site. If runoff from parking areas is not collected as part of the irrigation system, the parking areas could also be designed to drain towards landscaped areas with breaks provided in any curbs to help reduce the amount of runoff. These landscaped areas could act as mini detention areas which capture runoff and aid irrigation.

Sidewalks, curbs and gutters are recommended along both sides of Hardy Street and 'Umi Streets to help reduce the ponding that currently occurs when it rains and to improve pedestrian access. All onsite improvements will be designed to comply with all federal, state, and county laws regarding drainage, erosion control, and non-point source pollution. During construction phases, any possible impact to water quality will be minimized and mitigated by the implementation of appropriate erosion control measures and best management practices (BMPs). Examples include blocking drain and gutter inlets with filtering materials and erecting silt fences.

5.6.5 Electrical and Communication Systems

5.6.5.1 Existing Conditions

The Kaua'i Island Utility Cooperative (KIUC) generates electricity for Kaua'i. Hawaiian TelCom, formerly Verizon Hawai'i, provides telephone and other communications services to Kaua'i. Oceanic Time Warner Cable provides the cable television and internet service for Kaua'i.

5.6.5.2 Potential Impacts and Mitigation Measures

The proposed site improvements require minimal additional electrical service. It would mainly be required for lighting and the automatic irrigation system. No telephone or cable television service will be required for any of the proposed improvements. However, coordination with the various utility companies will be

undertaken to ensure that any existing conduits are appropriately relocated during the design and construction of the various site improvements.

The master plan also proposes to relocate existing overhead utility lines underground. Most are located along area roadways and down the center of the Civic Center along 'Eiwa Street. This will clear a wider area on sidewalks for pedestrian uses and street amenities and reduce the danger of toppling during high winds. It will also improve views from and within the Civic Center.

5.6.6 Solid Waste Disposal

5.6.6.1 Existing Conditions

Currently, the County of Kaua'i provides residential and limited commercial solid waste collection service for the island. Collection crews transport the refuse to transfer stations in Hanalei, Kapa'a, Hanapepe and Līhu'e. The waste is loaded on trailers and delivered to the Kekaha Phase II Landfill. The County also operates a Greenwaste Diversion Program through which residential and commercial green waste is diverted from the landfill and accepts them at four locations on Kaua'i. Green waste is chipped, mulched and reused in landscape applications.

5.6.6.2 Potential Impacts and Mitigation Measures

No long-term increase in solid waste generation is anticipated from the proposed site improvements. During construction, all green waste will be collected for the County's Greenwaste Diversion Program or chipped into mulch for use onsite. Recyclable construction wastes such as asphalt and concrete will also be reprocessed and reused for repaving parking lots or crushed for fill. All remaining construction waste will be disposed of in compliance with all State and County laws and ordinances.

After construction is completed, the proposed site improvements will generate very little additional solid waste. Green wastes will be the main type of waste generated and these are easily salvaged for mulch.

5.7 PUBLIC SERVICES

5.7.1 Police Protection

5.7.1.1 Existing Conditions

The Kaua'i Police Department has three stations located approximately 25 miles apart. The main station and administrative headquarters are located in Līhu'e at the new County facility off Ka'ana Street near Kapule Highway. Satellite stations are located at Waimea, Hanalei and co-located with fire stations.

5.7.1.2 Potential Impacts and Mitigation Measures

The proposed site improvements are intended to draw residents and visitors to the Civic Center. An anticipated increase of activity and visitors will potentially result in unavoidable demand for police protection services. However, it is anticipated that these needs will be intermittent and not significantly different from existing requirements. Existing police service is anticipated to be sufficient to protect the area. The close proximity of the police headquarters should mitigate any demands on police services and allow for short response times.

5.7.2 Fire Protection

5.7.2.1 Existing Conditions

The Kaua'i Fire Department has a station and administrative headquarters in Līhu'e. There are six additional fire stations around the island.

5.7.2.2 Potential Impacts and Mitigation Measures

All the proposed site improvements will be designed to meet appropriate building codes and safety requirements. Because the proposed site improvements are intended to draw residents and visitors to the Civic Center, the anticipated increase of activity and visitors will potentially result in unavoidable demand for fire protection services. However, it is anticipated that these needs will be intermittent and not significantly different from existing requirements. Existing fire service will be sufficient to protect the area. The close proximity of the Līhu'e Fire Station should provide quick response times to any incidents reported at the project site.

5.7.3 Education

5.7.3.1 Existing Conditions

The project site is located within the State Department of Education (DOE) Līhu'e School District. Within the District, there is one high school, Kaua'i High School (Grades 9-12), one middle school, Kamakahelei Middle School (Grades 6-8), and two elementary schools, Wilcox Elementary School (Pre-Kindergarten to Grade 5) and Kaumuali'i Elementary School (Pre-Kindergarten to Grade 5). There is also one private school, Island School which serves Pre-Kindergarten to Grade 12. The school within the closest proximity to the proposed site improvements is Wilcox Elementary School. It is located one block to the east, across 'Umi Street.

5.7.3.2 Potential Impacts and Mitigation Measures

The proposed site improvements will not increase resident population in the area. Thus, there should be no impact on existing educational services.

The design of the proposed roundabout and splitter islands at the 'Umi and Hardy Street intersection will accommodate Wilcox Elementary School's existing driveways and crosswalks. During peak drop-off and pick-up times, Wilcox Elementary School

officials say that the queue of cars entering their parking lots back up on 'Umi Street which may affect operation of the roundabout. This problem did not occur when parents were allowed to use the War Memorial parking lot as a student drop-off/pick-up area. However, due to a conflict in liability issues, the State did not want to continue this arrangement and the County now bans student pick up and drop off in this parking lot. After discussions with both County and Wilcox Elementary School officials, both sides are willing to work together to revisit this option. School officials thought the roundabout was a good idea and liked the design but want to make sure that their operations do not affect the traffic in this area. Further discussions should be held between the County and State to see if reinstating this arrangement would be feasible. It would eliminate the back up of cars queuing along 'Umi Street and provide a safe place for students to be picked up and dropped off.

5.7.4 Health Care Services

5.7.4.1 Existing Conditions

There are three major hospitals on Kaua'i. They are the Kaua'i Veterans Memorial Hospital in Waimea, the Samuel Mahelona Hospital in Kapa'a and the Wilcox Memorial Hospital in Līhu'e. Wilcox Hospital, the closest hospital to the project site, is located less than a half-mile north of the Civic Center. It is a 71-bed facility that provides acute care and emergency services. Within the second and third floors of the hospital is the 110-bed Garden Island Health Care, which provides long-term care. Together, the three hospitals operate four advanced life support ambulances.

5.7.4.2 Potential Impacts and Mitigation Measures

There will be an unavoidable and occasional need for emergency health care services. However, the proposed site improvements are located in close proximity to Wilcox Hospital. Since the proposed uses are essentially the same, no significant increase on existing emergency or health care services are anticipated.

5.7.5 Recreational Facilities

5.7.5.1 Existing Conditions

Within the Līhu'e District, the County has over 95 acres of parks. In the immediate vicinity of the Civic Center, there are several recreational facilities. They include:

- Līhu'e Park (little league and pony fields, practice soccer field)
- Līhu'e County Park (tennis courts)
- Kalena Park (basketball court, playground equipment)
- Isenberg Park (softball, practice football field, playground equipment)
- Molokoa Park (no facilities)
- Vidinha Stadium (Athletic Complex, Baseball Field, Lighted Football Field, Track, 10 Acre Parcel Adjacent to Vidinha Stadium Converted to Soccer Fields)

5.7.5.2 Potential Impacts and Mitigation Measures

The proposed site improvements at the Civic Center are not expected to negatively impact existing recreational facilities. Once completed, it will enhance existing recreational opportunities for residents, workers and visitors in Līhu'e since it provides a different kind of open space from existing facilities. Most of the existing facilities are for active recreation consisting of playfields and play equipment. In contrast, the proposed master plan creates a campus-like environment within the heart of the Civic Center. It will be an urban recreational facility with formal pedestrian pathways, benches, and shady canopy trees. It will provide a place for more passive activities such as meeting with friends and coworkers for lunch as well as provide event spaces for community festivals and celebrations. The proposed site improvements will have a positive impact by increasing the number and adding variety to Līhu'e's recreational amenities.

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6.0 DESCRIPTION OF ALTERNATIVES

In compliance with the provisions of Title 11, Department of Health, Chapter 200, Environmental Impact Statement Rules, Section 11-200-17(f), the "known feasible" alternatives to the proposed project are limited to those that would allow the objectives of the project to be met, while minimizing potential adverse environmental impacts. As such, the Līhu'e Civic Center Site Improvements have been evaluated in terms of the following alternatives.

6.1 NO ACTION ALTERNATIVE

Although the Civic Center is the government seat of Kaua'i, it lacks a sense of place and does not currently embody the spirit of a Civic Center. Although it has several civic and historic buildings onsite, it lacks the physical clarity and aesthetic quality of a Civic Center. There are no clear pedestrian paths connecting the buildings, vegetation is sparse and inconsistent, and nearly half of the site is covered with asphalt.

The "no action" alternative is not viable as the Civic Center will continue to be unsafe and uninviting to pedestrians. Parking lots will remain unorganized and dominate the view of the Civic Center. Multi-modal transportation systems are not supported. Traffic will continue to worsen, creating unsafe situations on the surrounding roadways and down the center of the Civic Center on 'Eiwa Street. As stated in Section 5.6.1, the only way to mitigate future traffic conditions at either end of 'Eiwa Street is to signalize the two intersections. The Civic Center would continue to lack a sense of place. The "no-action" alternative does not meet any of the project objectives or the vision for the Civic Center described in the General Plan.

6.2 DESIGN ALTERNATIVES

Several design alternatives were studied throughout the development of the master plan. The main differences between the alternatives involved 'Eiwa Street and the parking structures. This section reviews these design alternatives and discusses the rationale behind the pros and cons of each. It will also consider how well each alternative meets project objectives.

6.2.1 'Eiwa Street Alternatives

There are five basic design alternatives for 'Eiwa Street: 1) leave as is, the "no action" alternative described above, 2) realign 'Eiwa Street to intersect directly with 'Akahi and Wa'a Streets, 3) narrow 'Eiwa Street and provide curbs, sidewalks and street trees, 4) close a portion of 'Eiwa Street, and 5) close 'Eiwa Street entirely as recommended in the preferred alternative. Since the first and last alternatives are

described in Sections 6.1 and 6.3, respectively, the remaining alternatives will be discussed in this section.

6.2.1.1 Realigned 'Eiwa Street

Realigning 'Eiwa Street would have the benefit of simplifying intersections along Rice and Hardy Streets by creating four-way intersections with Wa'a and 'Akahi, respectively. This alternative was actually recommended in the 1976 Līhu'e Development Plan (see Figure 10). However, in order to have 'Eiwa Street match with Wa'a road, several large monkey pod trees at the County Lawn would have to be removed. It would also negatively impact the County Lawn which is in the Historic District by making it smaller. The realigned road would also create angled spaces on both sides of the road since 'Akahi and Wa'a do not line up with each other. This leads to less efficient design such as triangular shaped parking lots and unusable remnant spaces. This alternative leaves the Civic Center bisected in two halves and continues to allow cut-through vehicle traffic through the center of the Civic Center.

6.2.1.2 Narrowed Traffic Lanes, Sidewalks, and Landscaping on 'Eiwa Street

This alternative would make 'Eiwa Street safer and more pleasant for pedestrians by providing curbs, sidewalks, and street trees within the right-of-way. It would also narrow the traffic lanes which shortens the distance pedestrians must cross across the street. However, it does not improve the future traffic conditions at its intersections with Rice and Hardy Streets and mitigation at those intersections will eventually become necessary. Cut through traffic would still be allowed through the center of the Civic Center although the narrowed travel lanes may encourage drivers to slow down.

6.2.1.3 Partial Closure of 'Eiwa Street

There are three areas in which 'Eiwa Street could be partially closed: 1) on the Hardy Street side, 2) on the Rice Street side, or 3) in the center of the road. While there are a variety of benefits to this alternative, the same issue of the unaligned intersections at either one or two places would exist. Cut through traffic would be eliminated. However, multiple accesses and offset intersections along Rice and Hardy Streets unnecessarily complicate traffic movements. These conditions require drivers to monitor many situations which can lead to accidents or long delays. Safety in these areas would not be improved.

6.2.2 Location of the Parking Structures

Besides the two preferred locations for the parking structures, several onsite and offsite locations were considered.

6.2.2.1 Onsite Locations

Two other locations for the parking structures were considered onsite. The first is the Rice Street parking lot. This alternative was quickly eliminated since the depth of

that parking lot is too narrow to fit two double-loaded parking aisles required for the parking structure. Typically, a minimum of two driving aisles is recommended for parking structures so cars can circulate around the structure. Also, since parking structures are expensive to build, maximizing the number of stalls accessed by each aisle is encouraged. Therefore, two double-loaded parking aisles with a total depth of about 125 feet is the minimum depth needed for a parking structure.

The other alternative location considered was between the State Office Building and the Historic County Building. While there is sufficient space for a parking structure, this alternative was eliminated since it cuts through the Līhu'e Civic Center Historic District.

6.2.2.2 Offsite Locations

Offsite locations for parking structures and parking areas are still viable alternatives. Several of them are described in Section 2.4.2.4 and should be considered during the design process. These alternatives could either supplement or supplant the proposed parking structures within the Civic Center.

6.3 PREFERRED ALTERNATIVE

The preferred alternative is shown in Figure 1 and described in Section 2.0. It is the preferred alternative because it best implements the goals and objectives of the Civic Center, and balances the input from the County and the numerous recommendations gathered from the community. The proposed master plan closes 'Eiwa Street which unifies the project site into a pedestrian-friendly campus-like environment. Pedestrians can walk uninterrupted by traffic through the middle of the Civic Center from the Historic County Building to the Mo'ikeha Building. Traffic and parking areas are organized and simplified. The Civic Center gains 2.4 acres of landscaped public open space and improves its sense of place. The proposed master plan provides flexibility in its design while best meeting the projects objectives.

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7.0 DETERMINATION, FINDINGS, & REASONS FOR SUPPORTING THE DETERMINATION

To determine whether the proposed action may have a significant impact on the environment, including all phases of the project, expected consequences, both primary and secondary, cumulative as well as short- and long-term effects have been evaluated. Based on the research performed and studies evaluated, the Accepting Agency, the County of Kaua'i Department of Public Works, is anticipating a Finding of No Significant Impact (FONSI) as detailed in this section.

7.1 SIGNIFICANCE CRITERIA

According to the Department of Health Environmental Assessment Rules Section 11-200-12 HAR, an applicant or agency must determine whether an action may have a significant impact on the environment, including all phases of the project, its expected consequences both primary and secondary, its cumulative impact with other projects and its short and long-term effects. In making the determination, the rules establish "significance criteria" to be used as a basis for identifying whether significant environmental impact will occur. According to the Rules, an action shall be determined to have a significant impact on the environment if it meets any one of the following criteria:

(1) Involves an irrevocable commitment to loss or destruction of any natural or cultural resources;

The area proposed for site improvements has been extensively modified from its natural state. It is heavily urbanized with existing buildings and parking lots. Even the County Lawn is a modified environment with its manicured lawn and formal rows of royal palms. The proposed improvements primarily consist of landscaping, pedestrian paths, roadway and parking improvements and therefore do not involve an irrevocable commitment to loss or destruction of any natural resources.

The proposed improvements will not impact the historic buildings listed on the National and Hawai'i Registers of Historic Places. No changes are recommended for the historic buildings. In fact, most of the existing buildings, historic or not, are not affected by the proposed improvements.

Should any archaeologically significant artifacts, bones or other cultural or archaeological resources be discovered during construction, excavation or grading, work will stop immediately within the area of the find and the State Historic Preservation Division will be contacted for appropriate action and mitigation if necessary.

(2) Curtails the range of beneficial uses of the environment;

Most of the improvements involve the enhancement of the existing facilities and will not alter the existing uses. Proposed site improvements include adding pedestrian paths and walkways between existing buildings, reorganizing existing parking areas, expanding open spaces and installing landscaping. Thus, the proposed master plan will enhance, rather than curtail, the beneficial uses of the environment.

(3) Conflicts with the State's long-term environmental policies or goals and guidelines as expressed in Chapter 344, HRS; and any revisions thereof and amendments thereto, court decisions, or executive orders;

The proposed site improvements are consistent with the Environmental Policies established in Chapter 344, HRS as follows:

- Encourage management practices which conserve and protect … open space areas (HRS 344-4 (2) (D)).
- Foster the planting of native as well as other trees, shrubs, and flowering plants compatible to the enhancement of our environment (HRS 344-4 (3) (B)).
- Establish, preserve and maintain scenic, historic, cultural, park and recreation areas, including the shorelines, for public recreational, educational, and scientific uses (HRS 344-4 (4) (A)).
- Promote open space in view of its natural beauty not only as a natural resource but as an ennobling, living environment for its people (HRS 344-4 (4) (C)).

The proposed master plan increases the amount of open space made available for public enjoyment within the civic heart of Līhu'e. Native plants are recommended for the landscaping within the project area. Historic buildings and scenic views are preserved by the proposed improvements. The proposed master plan fits well within the State's environmental policies as established in Chapter 344 HRS.

(4) Substantially affects the economic or social welfare and cultural practices of the community or State;

The proposed site improvements are expected to positively affect the social and economic welfare of the Līhu'e community. By creating more comfortable, convenient and safe pedestrian environments, the proposed master plan provides opportunities for the community to gather and enjoy the outdoor areas of the Civic Center. Cultural practices of the community are enhanced by the installation of interpretive signage for historic resources, educating the public about their significance. Construction activities will provide temporary employment benefits while the revitalization of the Civic Center could encourage economic redevelopment in Līhu'e Town.

(5) Substantially affects public health;

Impacts to public health may be temporarily affected by air, noise, and water quality impacts during construction. However, these will be short in duration and minimal when weighted against the social benefits associated with the proposed improvements.

(6) Involves substantial secondary impacts, such as population changes or effects on public facilities;

The proposed site improvements are not expected to have substantial secondary impacts such as population changes since the use remains the same. The Civic Center itself is a public facility and therefore serves rather than affects public facilities such as schools, fire, and police protection requirements. The proposed improvements will have a positive impact on public facilities in that the Civic Center itself will be revitalized.

(7) Involves a substantial degradation of environmental quality;

The project site is located in an existing urbanized area and will not involve a substantial degradation of environmental quality. The area has been extensively modified by development and urbanization over the past 180 years. The Master Plan seeks to improve the environmental quality of the area through the expansion of open space and permeable surfaces and through the use of Native landscaping. Stormwater runoff will be further reduced if rooftop catchment systems are installed for irrigation.

(8) Is individually limited but cumulatively has considerable effect on the environment, or involves a commitment for larger actions;

The proposed site improvements will not have a cumulative negative effect on the existing urban environment nor will it involve a commitment for larger actions since all the proposed improvements are focused on revitalizing the Civic Center. The improvements could be undertaken in many ways that fit the priorities and fiscal capabilities of the County at any moment in time. In addition, various alternatives and their estimated costs are presented in the plan in order to provide options to County decision makers. Construction-related impacts would be short term and would occur over several years as the facilities are built.

(9) Substantially affects a rare, threatened or endangered species or its habitat;

The Civic Center area has been significantly modified from its natural state by urbanization. No rare, threatened or endangered species are known to exist within the area. However, shielded, downward-facing outdoor lights will be used to minimize the impact to the threatened Newell shearwater should they fly over the

site. Also, the expanded open spaces and increased landscaping could provide habitat for other species in the vicinity.

(10) Detrimentally affects air or water quality or ambient noise levels;

During construction, short-term potential impacts on air quality, noise, and water quality may occur. However, these impacts are temporary and will not negatively affect long-term air or water quality or noise levels. The additional landscaping and will help clean the air by absorbing carbon and producing oxygen. Street trees will help trap air pollution particles. Stormwater runoff should be reduced with the increase in pervious surfaces. In addition, the trees and landscaping will help buffer noise from surrounding roads and other uses.

(11) Affects or is likely to suffer damage by being located in an environmentally sensitive area, such as a flood plain, tsunami zone, beach, erosion-prone area, geologically hazardous land, estuary, freshwater, or coastal waters.

The Civic Center is not located within an area of flood concern. It is located inland, away from the shoreline and beaches and is outside of the tsunami evacuation area. It is located outside of the 500-year floodplain. The proposed site improvements are not located in erosion-prone areas or geologically hazardous land. There are no estuaries, freshwater or coastal waters within the project site. See Sections4.2, 4.3 and 4.4 for more details.

(12) Substantially affects scenic vistas and view planes identified in County or State plans or studies;

There are no scenic views or vistas related to the Civic Center in the County's Heritage Resource Map from the General Plan. However, the Civic Center is located on a plateau with distant views of Ha'upu and Wai'ale'ale. The proposed master plan preserves those views by recommending that parking structures be built below grade and overhead utilities be relocated underground. Additional landscaping including large canopy trees will be installed. However, the landscaping will ultimately beautify the area. No other proposed improvements are anticipated to affect scenic views.

(13) Requires substantial energy consumption.

Construction of the proposed project will not require substantial energy consumption relative to other similar projects. Once implemented, the improvements will not require significant amounts of additional energy consumption. The main improvements that will require energy are the lighting and irrigation system. The additional trees and increase in landscaped areas may help to reduce energy consumption of the Civic Center buildings by reducing the heat island effect, common in urbanized areas, reducing the need for cooling. The proposed site

improvements may also reduce the number of motorized trips and gasoline consumption by creating a pedestrian-friendly environment that encourages people to walk rather than drive their cars in and around the Civic Center.

7.2 DETERMINATION

On the basis of the above criteria, the discussion of impacts and mitigation measures as well as public comments received and contained in this document, the Accepting Agency, the Department of Public Works finds that the Līhu'e Civic Center Site Improvements Master Plan will not have a significant effect on the environment. Pursuant to Chapter 343, Hawai'i Revised Statutes, the Accepting Agency issues a Finding of No Significant Impact (FONSI) for the proposed project.

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8.0 REFERENCES

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9.0 COMMENT LETTERS ON THE DRAFT ENVIRONMENTAL ASSESSMENT AND RESPONSES

The following is a list of agencies, organizations, and individuals to whom the Draft EA was mailed for comment and the date of their comment letters. Copies of the comment letters and the responses are attached in their entirety on the following pages.

NO.	AGENCY/ORGANIZATION/INDIVIDUAL	DATE DRAFT EA MAILED	DATE OF COMMENT LETTER
	STATE		
1	Office of Environmental Quality Control	7/20/2007	7/27/2007
2	Department of Accounting and General Services (DAGS) – Kaua'i Branch	7/20/2007	
3	Department of Business, Economic Development, and Tourism (DBEDT) – Office of Planning	7/20/2007	
4	Department of Education	7/20/2007	8/16/2007
5	Wilcox Elementary School	7/20/2007	8/27/2007
6	Department of Health – Environmental Planning Office	7/20/2007	
7	Department of Land and Natural Resources (DLNR)	7/20/2007	8/3/2007
8	DLNR – State Historic Preservation Division (SHPD)	7/20/2007	7/25/2007 9/13/2007
9	DLNR – SHPD Kaua'i Office	7/20/2007	
10	DLNR - Division of Forestry and Wildlife, Kaua'i	7/24/2007	
11	Department of Transportation (DOT)	7/20/2007	8/15/2007
12	DOT – Highways Division, Kaua'i District	7/27/2007	8/22/2007
13	Office of Hawaiian Affairs	7/20/2007	8/23/2007
	FEDERAL		
14	Līhu'e Post Office	7/20/2007	
	COUNTY		
15	Department of Public Works (DPW)	7/20/2007	
16	Fire Department	7/20/2007	
17	Planning Department	7/20/2007	
18	Police Department	7/20/2007	
19	DPW – Engineering Division	7/20/2007	
20	Transportation Agency	7/20/2007	8/21/2007
21	Department of Water	7/20/2007	8/21/2007

NO.	AGENCY/ORGANIZATION/INDIVIDUAL	DATE DRAFT EA MAILED	DATE OF COMMENT LETTER
	LIBRARIES		
22	Līhu'e Regional Library	7/20/2007	
	ELECTED OFFICIALS		
23	Kaipo Asing, County Council Chair	7/20/2007	
	UTILITIES		
24	Kaua'i Island Utility Cooperative	7/20/2007	
25	Hawaiian Telcom	7/20/2007	
	COMMUNITY GROUPS		
26	Līhu'e Business Association	7/20/2007	

LINDA LINGLE
GOVERNOR OF HAWAI'I

LAURENCE K. LAU
ACTING DIRECTOR

RECEIVED
JUL 30 2007
PBR HAWAII

STATE OF HAWAI'I
DEPARTMENT OF HEALTH
OFFICE OF ENVIRONMENTAL QUALITY CONTROL
235 SOUTH BERETANIA STREET
LEIOPAPA A KAMEHAMEHA, SUITE 702
HONOLULU, HAWAI'I 96813
Telephone (808) 586-4185
Facsimile (808) 586-4186
Electronic Mail: OEQC@doh.hawaii.gov

July 27, 2007

Douglas Haigh
Building Division Chief
County of Kaua'i
Department of Public Works
4444 Rice Street
Lihue, Hawaii 96766-1340

Subject: Līhu'e Civic Center Site Improvements Master Plan Draft Environmental Assessment (DEA), District of Līhu'e, Kaua'i, Hawai'i

Dear Mr. Haigh:

Thank you for the opportunity to review the subject document. We offer the following comment:

Please address the mitigation of stormwater management and erosion control during the grading and excavation phase for the underground parking lots on part 5.1.2, page 5-2.

Should you have any questions, please call Herman Tuiolosega at 586-4185.

Sincerely,

George Casen

George Casen
Planner

c: Donald M. Fujimoto, County Engineer
Kimi Yuen, PBR Hawaii

PBR HAWAII
& ASSOCIATES, INC.

HONOLULU OFFICE
1001 Bishop Street
ASB Tower, Suite 650
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Fax: (808) 961-4989

WAILUKU OFFICE
1787 Wili Pā Loop, Suite 4
Wailuku, Hawai'i 96793-1271
Tel: (808) 242-2878

September 5, 2007

Mr. George Casen, Planner
State of Hawai'i
Office of Environmental Quality Control
235 South Beretania Street, Suite 702
Honolulu, Hawai'i 96813

RE: Līhu'e Civic Center Site Improvements Master Plan
Draft Environmental Assessment, Līhu'e, Kaua'i, Hawai'i

Dear Mr. Casen:

Thank you for your letter dated July 27, 2007 regarding the Draft Environmental Assessment (EA) for the Līhu'e Civic Center Site Improvements Master Plan. With regards to your comments, we will add the following text to the end of the first paragraph in Section 5.1.2:

> The County will comply with all federal, state, and county laws regarding stormwater runoff and erosion control during the grading and excavation phases of the project and minimize any potential impact to historic resources by using best management practices such as erecting protective barriers and diverting any runoff away from these resources. The County will also design and construct the underground parking structures so as not to impact the foundations of the historic buildings.

Thank you for your comments and for reviewing the Draft EA. Your letter will be included in the Final EA/FONSI.

Sincerely,

PBR HAWAII

Kimi Yuen
Associate

cc: Mr. Laurence K. Lau/OEQC
Mr. Donald Fujimoto/County of Kaua'i Department of Public Works
Mr. Douglas Haigh/County of Kaua'i DPW-Building

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LINDA LINGLE
GOVERNOR OF HAWAII

ALLAN A. SMITH
INTERIM CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

KEN C. KAWAHARA
DEPUTY DIRECTOR - WATER

AQUATIC RESOURCES
BOATING AND OCEAN RECREATION
BUREAU OF CONVEYANCES
COMMISSION ON WATER RESOURCE MANAGEMENT
CONSERVATION AND COASTAL LANDS
CONSERVATION AND RESOURCES ENFORCEMENT
ENGINEERING
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION
KAHOOLAWE ISLAND RESERVE COMMISSION
LAND
STATE PARKS

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES

STATE HISTORIC PRESERVATION DIVISION
601 KAMOKILA BOULEVARD, ROOM 555
KAPOLEI, HAWAII 96707

RECEIVED
AUG 03 2007
PBR HAWAII

July 25, 2007

LOG NO: 2007.2552
DOC NO: 0707NM39
Archaeology

Kimi Yuen
PBR Hawaii
100 Bishop Street, ASB Tower, Suie 650
Honolulu, Hawaii 96813

Dear Ms. Yuen:

SUBJECT: **Chapter 6E-42 Historic Preservation Review - DEA (County Of Kauai – Public Works Department)**
Lihue Civic Center Site Improvements Master Plan
Lihue, Kauai
TMK: (4) 3-6-005: 01, 02, 03, 06, 11, 27, 28 and 30

The aforementioned project is a master plan for site improvements to the Lihue Civic Center, focusing on improving pedestrian walkways and parking areas. According to the DEA, the area has been heavily modified by urban development and most improvements will require minor grading.

We believe that "**no historic properties will be affected**," because:
- ☒ Intensive cultivation has altered the land
- ☒ Residential development/urbanization has altered the land
- ☒ Previous grubbing/grading has altered the land
- ☐ An accepted archaeological inventory survey (AIS) found no historic properties
- ☐ SHPD previously reviewed this project and mitigation has been completed
- ☐ Other:

In the event that historic resources, including human skeletal remains, are identified during routine construction activities, all work needs to cease in the immediate vicinity of the find, the find needs to be protected from additional disturbance, and the State Historic Preservation Division, Kauai Section, needs to be contacted immediately at (808) 742-7033.

Aloha,

Melanie Chinen, Administrator
State Historic Preservation Division

NM:

PBR HAWAII
& ASSOCIATES, INC.

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1001 Bishop Street
ASB Tower, Suite 650
Honolulu, Hawai'i 96813-3484
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E-mail: sysadmin@pbrhawaii.com

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Fax: (808) 961-4989

WAILUKU OFFICE
1787 Wili Pā Loop, Suite 4
Wailuku, Hawai'i 96793-1271
Tel: (808) 242-2878

September 5, 2007

Ms. Melanie Chinen, Administrator
DLNR-State Historic Preservation Division
601 Kamokila Boulevard, Room 555
Kapolei, Hawai'i 96707

RE: Līhu'e Civic Center Site Improvements Master Plan
Draft Environmental Assessment, Līhu'e, Kaua'i, Hawai'i
(Log No: 2007.2552, Doc No. 0707NM39)

Dear Ms. Chinen:

Thank you for your letter dated July 25, 2007 regarding the Draft Environmental Assessment (EA) for the Līhu'e Civic Center Site Improvements Master Plan. We acknowledge your comment that no historic properties will be affected because intensive cultivation has altered the land, that residential development/urbanization has altered the land, and that previous grubbing/grading has altered the land.

We will also revise the third sentence, first paragraph of Section 5.1.2 to read:

> Should any historic remains, such as artifacts, burials, concentrations of shell or charcoal be encountered during construction, all work in the immediate vicinity of the find will cease and the find will be protected from additional disturbance. The State Historic Preservation Division, Kaua'i Section will also be contacted immediately for appropriate action and mitigation in accordance with Chapter 6E, Hawai'i Revised Statutes, as necessary.

Thank you for your comments and for reviewing the Draft EA. Your letter will be included in the Final EA/FONSI.

Sincerely,

PBR HAWAII

Kimi Yuen
Associate

cc: Mr. Laurence K. Lau/OEQC
Mr. Donald Fujimoto/County of Kaua'i Department of Public Works
Mr. Douglas Haigh/County of Kaua'i DPW-Building

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LINDA LINGLE
GOVERNOR OF HAWAII

LAURA H. THIELEN
INTERIM CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

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STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

August 3, 2007

PBR Hawaii
1001 Bishop Street
ASB Tower Suite 650
Honolulu, Hawaii 96813

Attention: Ms. Kimi Yuen

Gentlemen:

Subject: Draft Environmental Assessment for Lihue Civic Center Site Improvements Master Plan, Lihue, Kauai, Tax Map Key: (4) 3-6-5:1, 2, 3, 6, 11, 27, 28, 30

Thank you for the opportunity to review and comment on the subject matter. The Department of Land and Natural Resources' (DLNR) Land Division distributed or made available a copy of your report pertaining to the subject matter to DLNR Divisions for their review and comment.

Other than the comments from Land Division – Kauai District, the Department of Land and Natural Resources has no other comments to offer on the subject matter. Should you have any questions, please feel free to call our office at 587-0433. Thank you.

Sincerely,

Russell Y. Tsuji
Administrator

LINDA LINGLE
GOVERNOR OF HAWAII

ALLAN A. SMITH
INTERIM CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

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LAND DIVISION
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DEPT. OF LAND & NATURAL RESOURCES
STATE OF HAWAII

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

July 25, 2007

MEMORANDUM

TO: **DLNR Agencies:**
__Div. of Aquatic Resources
__Div. of Boating & Ocean Recreation
__Engineering Division
__Div. of Forestry & Wildlife
__Div. of State Parks
__Commission on Water Resource Management
__Office of Conservation & Coastal Lands
x Land Division – Kauai District

FROM: Russell Y. Tsuji
SUBJECT: Draft Environmental Assessment, Lihue Civic Center Site Improvements Master Plan
LOCATION: Lihue, Kauai, Tax Map Key: (4) 3-6-5:1, 2, 3, 6, 11, 27, 28, 30
APPLICANT: PBR Hawaii on behalf of County of Kauai, Department of Public Works

Transmitted for your review and comment on the above referenced document. We would appreciate your comments on this document. Please submit any comments by August 15, 2007.

If no response is received by this date, we will assume your agency has no comments. If you have any questions about this request, please contact my office at 587-0433. Thank you.

Attachments

( ) We have no objections.
(X) We have no comments.
( ) Comments are attached.

Signed:
Date: 7/30/07

PBR HAWAII
& ASSOCIATES, INC.

September 5, 2007

Mr. Russell Y. Tsuji, Administrator
State of Hawai'i
Department of Land and Natural Resources – Land Division
PO Box 621
Honolulu, Hawai'i 96809

RE: Līhu'e Civic Center Site Improvements Master Plan
Draft Environmental Assessment, Līhu'e, Kaua'i, Hawai'i

Dear Mr. Tsuji:

Thank you for your letter dated August 3, 2007 regarding the Draft Environmental Assessment (EA) for the Līhu'e Civic Center Site Improvements Master Plan. We recognize that the Department of Land and Natural Resources, including the Land Division - Kaua'i District, have no comments on this project.

Thank you for reviewing the Draft EA. Your letter will be included in the Final EA/FONSI.

Sincerely,

PBR HAWAII

Kimi Yuen
Associate

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1001 Bishop Street
ASB Tower, Suite 650
Honolulu, Hawai'i 96813-3484
Tel: (808) 521-5631
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Tel: (808) 242-2878

cc: Mr. Laurence K. Lau/OEQC
Mr. Donald Fujimoto/County of Kaua'i Department of Public Works
Mr. Douglas Haigh/County of Kaua'i DPW-Building

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
869 PUNCHBOWL STREET
HONOLULU, HAWAII 96813-5097

IN REPLY REFER TO:

STP 8.2579

August 15, 2007

Ms. Kimi Yuen
PBR Hawaii & Associates, Inc.
1001 Bishop Street
ASB Tower, Suite 650
Honolulu, Hawaii 96813

Dear Ms. Yuen:

Subject: Lihue Civic Center Site Improvements Master Plan
Draft Environmental Assessment (DEA)
TMK: 3-6-05: 01, 02, 03, 06, 11, 27, 28, and 30 and portions of Rice Street, Hardy Street, Umi Street, Kuhio Highway, and Kaumauali'I Highway and Eiwa Street

Thank you for your transmittal requesting our comments on the subject plan for site improvements to the Lihue Civic Center. The proposed improvements will include: new pedestrian paths, expanded park area, and new parking, bicycle and bus facilities.

The Traffic Impact Analysis Report (TIAR) for the subject master plan identified potential impact and mitigation measures that involve facilities at or next to our highways. The County Public Works Department should consult with our Highways Division, Kauai District Office, on the following described in the TIAR:

1. Adjusting the traffic signal at the Rice Street/Kuhio Highway/Kaumualii Highway intersection.
2. Adding a second left turn to the Rice Street approach to the Kuhio Highway/Kaumualii Highway intersection.
3. Signalizing the Kuhio Highway/Hardy Street intersection.
4. Striping bicycle lanes on Hardy Street and Umi Street, with bicycle routes on Kuhio Highway and Rice Street.

We appreciate the opportunity to provide our comments.

Very truly yours,

BARRY FUKUNAGA
Director of Transportation

c: Kauai Departmart of Public Works (Douglas Haigh & Donald Fujimoto)
Office of Environmental Quality Control

PBR HAWAII
& ASSOCIATES, INC.

September 5, 2007

Mr. Barry Fukunaga, Director
State of Hawai'i
Department of Transportation
869 Punchbowl Street
Honolulu, Hawai'i 96813-5097

RE: Līhu'e Civic Center Site Improvements Master Plan
Draft Environmental Assessment, Līhu'e, Kaua'i, Hawai'i
(STP 8.2579)

Dear Mr. Fukunaga:

Thank you for your letter dated August 15, 2007 regarding the Draft Environmental Assessment (EA) for the Līhu'e Civic Center Site Improvements Master Plan. With regards to your comments, we will inform the County of Kaua'i Department of Public Works to consult with your Highways Division, Kaua'i District Office on the following matters:

1. Adjusting the traffic signal at the Rice Street/Kūhiō Highway/Kaumuali'i Highway intersection.
2. Adding a second left turn lane to the Rice Street approach to the Kūhiō Highway/Kaumuali'i Highway intersection.
3. Signalizing the Kūhiō Highway/Hardy Street intersection.
4. Striping bicycle lanes on Hardy Street and 'Umi Street, with bicycle routes on Kūhiō Highway and Rice Street.

Please also note that the DOT Highways Division, Kaua'i District Office was included in the distribution of the Draft EA and also submitted comments which we will address in the Final EA.

Thank you for your comments and for reviewing the Draft EA. Your letter will be included in the Final EA/FONSI.

Sincerely,

PBR HAWAII

Kimi Yuen
Associate

cc: Mr. Laurence K. Lau/OEQC
Mr. Donald Fujimoto/County of Kaua'i Department of Public Works
Mr. Douglas Haigh/County of Kaua'i DPW-Building

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LINDA LINGLE
GOVERNOR

PATRICIA HAMAMOTO
SUPERINTENDENT

STATE OF HAWAI'I
DEPARTMENT OF EDUCATION
P.O. BOX 2360
HONOLULU, HAWAI'I 96804

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OFFICE OF THE SUPERINTENDENT

August 16, 2007

Ms. Kimi Yuen
PBR Hawaii
1001 Bishop Street
ASB Tower, Suite 650
Honolulu, Hawai`i 96813

Dear Ms. Yuen:

Subject: Master Plan for Lihu`e Civic Center, Lihu`e, Kauai

The Department of Education (DOE) has reviewed the Draft Environmental Assessment (DEA) for the Lihu`e Civic Center. The DOE's concerns center on proposed changes to the intersection of `Umi Street and Hardy Street. The DEA states that a proposed roundabout and splitter islands would accommodate Wilcox Elementary School's existing driveways and crosswalks. However, as illustrated, the splitter islands would prohibit left turns into and left turns out of one of the school's parking lots.

The DEA states that traffic going north on `Umi Street is operating at an "F" level of service in peak morning traffic and level "E" during peak afternoon traffic. In addition, the DEA says school officials acknowledge that during peak traffic times at the school, traffic waiting to enter the school creates congestion down `Umi Street.

The DOE has concerns that a proposed roundabout may not sufficiently address the congestion on `Umi Street and may limit circulation in and out of the campus. As a potential mitigation of traffic on `Umi Street, the DEA also describes an option of using a county parking lot in a different area as a student drop-off point. That option seems unlikely to the state. The DOE cautions that a roundabout and splitter islands may not be the best solution for that intersection. Should you have any questions, please call Heidi Meeker of the Facilities Development Branch at 733-4862.

Very truly yours,

Patricia Hamamoto
Superintendent

PH:jmb

cc: William Arakaki, CAS, Kapaa/Kauai/Waimea Complex Areas
Douglas Haigh, County of Kaua`i Department of Public Works
Donald Fujimoto, County of Kaua`i Department of Public Works
OEQC

AN AFFIRMATIVE ACTION AND EQUAL OPPORTUNITY EMPLOYER

PBR HAWAII
& ASSOCIATES, INC.

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September 5, 2007

Ms. Patricia Hamamoto, Superintendent
State of Hawai'i
Department of Education
PO Box 2360
Honolulu, Hawai'i 96804

RE: Līhu'e Civic Center Site Improvements Master Plan
Draft Environmental Assessment, Līhu'e, Kaua'i, Hawai'i

Dear Ms. Hamamoto:

Thank you for your letter dated August 16, 2007 regarding the Draft Environmental Assessment (EA) for the Līhu'e Civic Center Site Improvements Master Plan. With regards to your comments, we offer the following responses.

1. We apologize for the error on Figure 1. We have shortened the splitter island on 'Umi Street so that left turns will be allowed into an out of the Wilcox Elementary School driveway.

2. With regards to the roundabout sufficiently addressing congestion on 'Umi Street, a traffic study completed by M&E Pacific, Inc. for this project confirmed that a roundabout would adequately address traffic congestion with the highest volume-to-capacity (v/c) ratio of 0.70 on the eastbound approach on Hardy Street in the afternoon. All other approaches to the roundabout are projected to have lower v/c ratios. Roundabouts operate under capacity when the v/c ratio is less than 1.0. (See Appendix A of the EA for the full traffic study).

3. With regards to the option of relocating the student pick-up/drop-off area back to the County's War Memorial parking lot, we would still recommend that this option be pursued since both representatives from Wilcox Elementary School and the County are interested and willing to work together on this. We understand that there are liability issues. However, if both sides could negotiate an agreement about the liability issues, it would provide parents and students a safe place for pick-up and drop-off rather than on the surrounding streets and residential areas as is currently occurring.

Thank you for your comments and for reviewing the Draft EA. Your letter will be included in the Final EA/FONSI.

Sincerely,

PBR HAWAII

Kimi Yuen
Associate

cc: Mr. Laurence K. Lau/OEQC
Mr. Donald Fujimoto/County of Kaua'i Department of Public Works
Mr. Douglas Haigh/County of Kaua'i DPW-Building
Ms. Sherry Scott and Mr. Jason Kuloloia/Wilcox Elementary School

O:\Job22\2281.01 Lihue Civic Center\Reports\EA\Draft EA Response Letters\05 DOE.doc

Department of Water
County of Kaua'i

Water has no substitute.....Conserve it

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AUG 2 3 2007
PBR HAWAII

August 21, 2007

PBR Hawaii
Attention: Ms. Kimi Yuen
1001 Bishop Street. ASB Tower, Suite 650
Honolulu, HI 96813

Dear Ms. Yuen:

Subject: Draft Environmental Assessment, Lihue Civic Center Site Improvements Master Plan,
TMK: 3-6-05:001, 3-6-05:002, 3-6-05:003, 3-6-05:006, 3-6-05:011, 3-6-05:027, 3-6-05:028, and
TMK: 3-6-05:030, Lihue, Kaua'i, Hawai'i

The following are the Department of Water's draft Environmental Assessment comments for the proposed site improvements to the Lihue Civic Center; including new pedestrian paths, expanded park areas and irrigation, new parking structures, bicycle and bus facilities and potential sites for public art, gateway features and landmarks:

1. Any actual development or subdivision of the area will be dependent on the adequacy of the source, storage, and transmission facilities existing at that time. At the present time, water source and storage facilities are at capacity for the Lihue area.
2. The applicant is made aware that the Department of Water (DOW) has a water main along Eiwa Street. The main and any connections (water meter service, fire hydrant, detector check meters, etc.) will need to be abandoned if Eiwa Street is eliminated. The applicant will be responsible to relocate any water service connections, fire hydrants, detector check meters, etc. and to relocate/reconnect any plumbing affected by the abandonment of the main along Eiwa Street. Fire flows available from the two fire hydrants located along Eiwa Street will not be available when the main along Eiwa Street is abandoned.
3. The applicant is made aware that any roadway improvements may affect the Department's water facilities. It is recommended that the applicant submit construction drawings to the DOW Engineering Division for review and approval for any roadway improvements that will be done.
4. The applicant shall submit detailed water demand calculations along with the proposed meter size to the DOW for review and approval.

If you have any questions, please contact Mr. Keith Aoki at (808) 245-5418.

Sincerely,

Gregg Fujikawa
Chief of Water Resources and Planning

KA:mll
ea- lihue civic center w3-6-05-002 etc T-8883 rev

c: Office of Environmental Quality Control
Donald Fujimoto, COK-Department of Public Works
Douglas Haigh, COK-Department of Public Works

4398 Pua Loke St., P.O. Box 1706, Lihue, HI 96766 Phone: 808-245-5400
Engineering and Fiscal Fax: 808-245-5813, Operations Fax: 808-245-5402, Administration Fax: 808-246-8628

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September 5, 2007

Mr. Gregg Fujikawa, Chief of Water Resources & Planning
Department of Water
County of Kaua'i
4398 Pua Loke Street
PO Box 1706
Līhu'e, Hawai'i 96766

RE: Līhu'e Civic Center Site Improvements Master Plan
Draft Environmental Assessment, Līhu'e, Kaua'i, Hawai'i

Dear Mr. Fujikawa:

Thank you for your letter dated August 21, 2007 regarding the Draft Environmental Assessment (EA) for the Līhu'e Civic Center Site Improvements Master Plan. With regards to your comments, we offer the following responses:

1. Based on your letter, we understand that any actual development will be dependent on the adequacy of the source, storage, and transmission facilities existing at that time and that present water source and storage facilities are at capacity for the Līhu'e area and will forward this information to the County Department of Public Works (DPW). Please note, however, water will primarily be needed for irrigation purposes and the County is investigating whether non-potable water can be used. If non-potable water can be provided by either a rooftop catchment system and/or connection to Grove Farm's non-potable water source, or a combination of the two, then the need for service from the Department of Water's (DOW) potable drinking water system can be reduced or hopefully eliminated. The County will continue to investigate these alternatives during the engineering and detailed design stages of the project with the hopes of eliminating the project's impact on drinking water sources. Automatic irrigation systems with moisture sensors may also be installed to control the amount of water used for irrigation. The sensors can detect when there is enough moisture in the soil such as after a heavy rainfall and will shut off the irrigation system to avoid overwatering and wasting water. This information is provided in Section 5.6.2.2 of the EA. Should potable water be required for the project, the DPW will coordinate with your office during the detailed design and engineering of the project.

2. We thank you for alerting us about the DOW water main along 'Eiwa Street and fire hydrants. We will inform DPW and add the following text to the EA in Section 5.6.2.2: "There are also County of Kaua'i Department

of Water (DOW) water mains along 'Eiwa Street, Hardy Street, Rice Street, and 'Umi Street as well as Kūhiō Highway. During the detailed design of the improvements, care will be taken to minimize impact to the DOW system wherever possible. However, where mains or other connections such as water meter service, fire hydrants, etc. are impacted, DPW will coordinate early in the design phase with DOW to appropriately relocate these facilities in order to maintain service and provide fire protection. "

3. In addition to the above, we will inform DPW and add the following at the end of the new paragraph in Section 5.6.2.2: "DPW will submit construction drawings to the DOW Engineering Division for review and approval for any roadway improvements prior to construction."

4. We will inform DPW that should DOW service be required for the proposed improvements, they will need to submit to DOW detailed water demand calculations along with the proposed meter size required for the improvements. This will also be added to the end of the new paragraph in Section 5.6.2.2 of the EA.

Thank you for your comments and for reviewing the Draft EA. Your letter will be included in the Final EA/FONSI.

Sincerely,

PBR HAWAII

Kimi Yuen
Associate

cc: Mr. Laurence K. Lau/OEQC
Mr. Donald Fujimoto/County of Kaua'i Department of Public Works
Mr. Douglas Haigh/County of Kaua'i DPW-Building

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GOVERNOR

BARRY FUKUNAGA
DIRECTOR

Deputy Directors
MICHAEL D. FORMBY
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BRENNON T. MORIOKA
BRIAN H. SEKIGUCHI

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION
KAUAI DISTRICT
1720 HALEUKANA STREET
LIHUE, HAWAII 96766

IN REPLY REFER TO:
HWY-K 4.070678

August 22, 2007

Mr. Donald Fujimoto, P.E.
County Engineer
Department of Public Works
4444 Rice Street
Lihue, Kauai HI 96766

Attn: Mr. Douglas Haigh

Dear Mr. Fujimoto:

Subject: Lihue Civic Center Site Improvements Master Plan

Thank you for the opportunity to review the draft environmental assessment for the Lihue civic Center Site Improvements Master Plan. We have the following comments:

Page 5-13. Other Traffic Trends. The improvements to the Kuhio Highway, Kaumualii Highway, and Rice Street intersection were completed in 1999 and not in 1991 as stated in this section. The reductions in traffic volumes on Rice Street between 1993 and 1999 were probably due to the after effects of Hurricane Iniki. The sharp drop in volume between 1999 and 2001 is probably due to the reconfigured intersection.

Page 5-14. 5.6.1.3 Potential Impacts and Mitigation Measures. Haleko Road. We do not concur with the recommendation to ban left turns from Rice Street onto Haleko Road. Haleko Road is a much used route for traffic traveling between Rice Street and the Kukui Grove area and should remain as an alternative for motorists wanting to travel between the two areas.

If you have any questions, please call Stanford Iwamoto of our staff at 241-3015.

Sincerely,

STEVEN M. KYONO, P.E., M. ASCE
District Engineer

SMI:mr

PBR HAWAII
& ASSOCIATES, INC.

September 5, 2007

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Mr. Steven M. Kyono, P.E., M.ASCE
State of Hawai'i
Department of Transportation
Highways Division, Kaua'i District Office
1720 Haleukana Street
Līhu'e, Hawai'i 96766

RE: **Līhu'e Civic Center Site Improvements Master Plan**
Draft Environmental Assessment, Līhu'e, Kaua'i, Hawai'i
(HWY-K 4.070678)

Dear Mr. Kyono:

Thank you for your letter dated August 22, 2007 regarding the Draft Environmental Assessment (EA) for the Līhu'e Civic Center Site Improvements Master Plan. With regards to your comments, we offer the following responses.

1. Other Traffic Trends: We will correct the date of the Kūhiō Highway/Kaumuali'i Highway/Rice Street intersection improvements to 1999. We will also add the following text to this section on page 5-13 after the second sentence: "According to the State DOT-Highways Division Kaua'i District Office, the reductions in traffic volumes on Rice Street between 1993 and 1999 were probably due to the after effects of Hurricane 'Iniki while the drop in volume between 1999 and 2001 is probably due to the reconfigured intersection of Kaumuali'i Highway, Kūhiō Highway, and Rice Street." The original third sentence will be deleted.

2. Halekō Road: The text will be revised on page 5-15 in this section as follows after the third sentence: "If Halekō Road is not widened as proposed in the master plan, consideration should be given to making Halekō Road right turn in, right turn out at Rice Street to minimize the traffic growth on Halekō Road and to avoid traffic signals. Eastbound traffic would be diverted to Kaumuali'i Highway. The left turn from Rice Street onto Kaumuali'i Highway would have to be made into two lanes to accommodate the additional traffic. This widening should be coordinated with the planned widening of Kaumuali'i Highway to four lanes. If left turns are permitted from Rice Street on to Halekō Road, traffic signals will be required which could cause traffic operational problems on Rice Street. However, whether the signal is needed or the left turn should be eliminated can be evaluated at a future date by the State DOT-Kaua'i District Office and the County when traffic at this intersection becomes problematic."

Thank you for your comments and for reviewing the Draft EA. Your letter will be included in the Final EA/FONSI.

Sincerely,

PBR HAWAII

Kimi Yuen
Associate

cc: Mr. Laurence K. Lau/OEQC
Mr. Donald Fujimoto/County of Kaua'i Department of Public Works
Mr. Douglas Haigh/County of Kaua'i DPW-Building

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Bryan J. Baptiste
Mayor

Gary K. Heu
Administrative Assistant

OFFICES OF COMMUNITY ASSISTANCE
TRANSPORTATION AGENCY

Janine M. Z. Rapozo
Executive on Transportation

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August 21, 2007

PBR Hawaii and Associates, Inc.
1001 Bishop Street
ASB Tower, Suite 650
Honolulu HI 96813

Attn: Kimi Yuen

RE: Lihue Civic Center Site Improvements Master Plan

Thank you for the opportunity to provide comments on the Draft Environmental Assessment for the Lihue Civic Center Site Improvements Master Plan.

In regards to Table 3 on page 2-19, please correct the shuttle bus estimate per service hour to $59.69 per hour (2002 national average) as the original estimate provided was in error.

Please feel free to call me if you have any questions.

Sincerely,

Janine M.Z. Rapozo
Executive on Transportation

cc: Donald Fujimoto, County Engineer
Office of Environmental Quality Control

THE KAUA`I BUS
3220 Ho'olako Street
Lihue Kauai Hawaii 96766-1492
Telephone (808) 241 6410
Fax (808) 241 6417

PBR HAWAII
& ASSOCIATES, INC.

September 5, 2007

Ms. Janine Rapozo, Executive on Transportation
County of Kaua'i
Transportation Agency
3220 Ho'olako Street
Līhu'e, Hawai'i 96766-1492

RE: Līhu'e Civic Center Site Improvements Master Plan
Draft Environmental Assessment, Līhu'e, Kaua'i, Hawai'i

Dear Ms. Rapozo:

Thank you for your letter dated August 21, 2007 regarding the Draft Environmental Assessment (EA) for the Līhu'e Civic Center Site Improvements Master Plan. We will revise the cost estimate in Table 3 to $59.69 per service hour per your request. We will also revise the footnote at the bottom of the table to read: "*Note: 2002 national average, estimate includes all costs associated with operation (labor, fuel, maintenance, etc.) and was provided by Janine Rapozo, County Executive on Transportation."

Thank you for your comments and for reviewing the Draft EA. Your letter will be included in the Final EA/FONSI.

Sincerely,

PBR HAWAII

Kimi Yuen
Associate

cc: Mr. Laurence K. Lau/OEQC
Mr. Donald Fujimoto/County of Kaua'i Department of Public Works
Mr. Douglas Haigh/County of Kaua'i DPW-Building

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Tel: (808) 242-2878

Kimi Yuen

From: Sherry_Scott/WILCOX/HIDOE.
Sent: Monday, August 27, 2007 4:51 PM
To: Kimi Yuen
Cc: Jason_Kuloloia/WILCOX/HIDOE
Subject: Re: Lihue Civic Center Draft EA

Hello Kimi,
Jason Kuloloia is our new Principal. I had discussed this with Jason and intended on responding in writing before the Aug. 22 deadline. Unfortunately, I was out for five days with the flu and missed the deadline. The concerns that we have are as follows:

1) A great deal of the parent pick up and drop off traffic enters the cafeteria parking lot in the mornings and afternoon from Umi Street. A large majority of this traffic enter the cafe parking lot by turning left off of Umi St. into the parking lot. With the round about in place, it appears that the grass median will not allow cars to turn left from Umi Street into our cafeteria parking lot. This means that this traffic will be diverted to come around from the other direction on Rice St. and then to Umi to turn right into the cafe. This could create congestion in other areas.

2) It would be beneficial to the safety of our students to have flashing yellow lights in place on Hardy St. that indicate a school zone is ahead. The lights could be on a timer and only flash at the beginning and ending of the school day.

3) We currently have an existing fence at the back of our campus near where the pedestrian walkway to the War Memorial will be placed. Since this walkway will be open to the general public, we are concerned that some of the public may choose to cut across our campus. Currently, we have two open pathways in the fence at the back of our campus. To divert pedestrians from entering our campus, we would like to request that a gate be installed on each opening to discourage people from entering our campus. Total of two gates.

4) There are four crosswalks at the round about. I would like to request that the existing crosswalk in front of the school and public library remain on Hardy St. since many students use it to cross the street in the afternoon.

Thank you for allowing me this opportunity to provide feedback,
Sherry Scott, Vice Principal

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& ASSOCIATES, INC.

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KIMI MIKAMI YUEN, LEED® AP
Associate

SCOTT ALIKA ABRIGO
Associate

SCOTT MURAKAMI, ASLA
Associate

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September 5, 2007

Ms. Sherry Scott, Vice Principal
Wilcox Elementary School
4319 Hardy Street
Līhu'e, Hawai'i 96766

RE: Līhu'e Civic Center Site Improvements Master Plan
Draft Environmental Assessment, Līhu'e, Kaua'i, Hawai'i

Dear Ms. Scott:

Thank you for your email dated August 27, 2007 regarding the Draft Environmental Assessment (EA) for the Līhu'e Civic Center Site Improvements Master Plan. With regards to your comments, we offer the following responses:

1. We apologize for the error in Figure 1. We have corrected the splitter island on 'Umi Street so that left turns will be allowed from and out of the Wilcox Elementary School cafeteria parking lot driveway. We have attached a copy of the corrected plan for your reference.

2. We will forward your request for flashing yellow lights on Hardy Street to Ms. Heidi Meeker/State Department of Education-Facilities and Support Services Branch, Mr. Stanley Doi/State Department of Accounting and General Services-Kaua'i, and Mr. Doug Haigh/County of Kaua'i Department of Public Works-Building Division for their consideration.

3. We will also forward your request for a gate at the back of the campus to Ms. Heidi Meeker/State Department of Education-Facilities and Support Services Branch and Mr. Stanley Doi/State Department of Accounting and General Services-Kaua'i for their consideration. Based on our phone call on August 31, 2007, we understand that only one gate will be needed, rather than the two you originally recommended in your email.

4. The existing crosswalk in front of the school and public library will remain in its current location on Hardy Street even with the four crosswalks at the roundabout. In fact, the master plan recommends extending the median in Hardy Street to provide a pedestrian refuge at this crosswalk to make this crossing safer.

Thank you for your comments and for reviewing the Draft EA. Your letter will be included in the Final EA/FONSI.

Sincerely,

PBR HAWAII

Kimi Yuen
Associate

Attachment

cc: Mr. Laurence K. Lau/OEQC
Mr. Donald Fujimoto/County of Kaua'i Department of Public Works
Mr. Douglas Haigh/County of Kaua'i DPW-Building
Ms. Heidi Meeker/State DOE Facilities and Support Services Branch
Mr. Stanley Doi/State Department of Accounting and General Services-Kaua'i
Mr. Jason Kuloloia/Wilcox Elementary School

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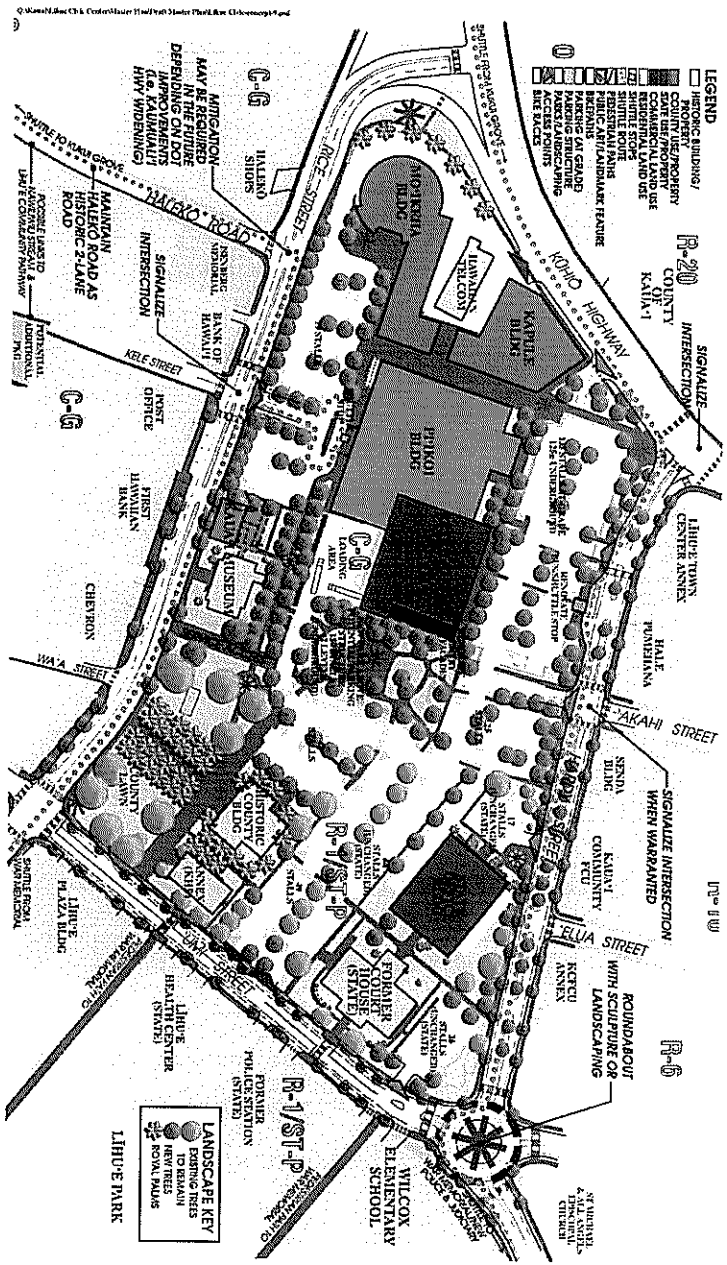

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OFFICE OF HAWAIIAN AFFAIRS
711 KAPI'OLANI BOULEVARD, SUITE 500
HONOLULU, HAWAI'I 96813

HRD07/3134

August 23, 2007

Kimi Yuen
Project Consultant
PBR Hawaii
1001 Bishop Street
ASB Tower, Suite 650
Honolulu, HI 96813

RE: Request for comments on the Draft Environmental Assessment for Līhu'e Civic Center Site Improvements Master Plan, Līhu'e, Kaua'i, TMKs: 3-6-005:001, 002, 003, 006, 011, 027, 028, and 030 and portions of Rice Street, Hardy Street, 'Umi Street, Kūhiō Highway, Kaumuali'i Highway and 'Eiwa Street

Dear Kimi Yuen,

The Office of Hawaiian Affairs (OHA) is in receipt of your July 23, 2007, request for comments on the above proposed project, which would include the development of an approximately 16-acre site in the center of Līhu'e. OHA offers the following comments.

OHA understands and respects the concept of the project and commends the County on following through with its vision, as described in the *Kaua'i General Plan Update 2000*. OHA also appreciates the level of detail and thoroughness seen throughout the work that PBR Hawaii has done on this Draft Environmental Assessment. We particularly note the effort to provide multiple, legitimate design alternatives.

OHA commends the applicant's intent to landscape using native plants and trees. Doing so will serve water-saving purposes and further the traditional Hawaiian concept of mālama 'āina and create a more Hawaiian sense of place.

Despite the fact that the project area has already been urbanized, we request the applicant's assurances that should iwi kūpuna or Native Hawaiian cultural or traditional deposits be found during ground disturbance or excavation, work will cease, and the appropriate agencies will be

contacted pursuant to applicable law. Cultural materials continue to be found in urbanized areas, as witnessed in downtown Honolulu.

Thank you for the opportunity to comment. If you have further questions, please contact Heidi Guth at (808) 594-1962 or e-mail her at heidig@oha.org.

Sincerely,

Clyde W. Nāmu'o
Administrator

C: Kanani Kagawa
Cultural Resources Coordinator
OHA – Kaua'i Office
3-3100 Kuhio Hwy., Suite C4
Līhu'e, HI 96766

Douglas Haigh, Building Division Chief
County of Kaua'i
Department of Public Works
4444 Rice Street, Suite 175
Līhu'e, HI 96766

Donald Fujimoto, County Engineer
County of Kaua'i
Department of Public Works
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Office of Environmental Quality Control
235 South Beretania St.
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& ASSOCIATES, INC.

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September 5, 2007

Mr. Clyde W. Nāmu'o, Administrator
State of Hawai'i
Office of Hawaiian Affairs
711 Kapi'olani Boulevard, Suite 500
Honolulu, Hawai'i 96813

RE: **Līhu'e Civic Center Site Improvements Master Plan**
Draft Environmental Assessment, Līhu'e, Kaua'i, Hawai'i
(HRD07/3134)

Dear Mr. Nāmu'o:

Thank you for your letter dated August 23, 2007 regarding the Draft Environmental Assessment (EA) for the Līhu'e Civic Center Site Improvements Master Plan. With regards to your comments, we offer the following responses.

1. We appreciate your positive comments regarding the vision, level of detail, thoroughness, and multiple, legitimate alternatives presented in the Draft EA.

2. We also thank you for your support of using native plants and trees to further the traditional Hawaiian concept of mālama 'āina and to create a more Hawaiian sense of place.

3. We recognize your concerns about the potential to find historic remains even in existing urbanized areas and will revise Section 5.1.2 with the following text, inserted after the second sentence:

> Although the project is located in an existing urbanized area, it is possible that historic remains may be found during groundwork. Should any historic remains, such as artifacts, burials, concentrations of shell or charcoal be encountered during construction, all work in the immediate vicinity of the find will cease and the find will be protected from additional disturbance. The State Historic Preservation Division, Kaua'i Section will also be contacted immediately for appropriate action and mitigation in accordance with Chapter 6E, Hawai'i Revised Statutes, as necessary.

This section of the Draft EA has also been revised with input from the State Historic Preservation Division and the above text reflects their concerns as well. We will also be sure to forward your letter to the County so they are aware of your concerns.

Thank you for your comments and for reviewing the Draft EA. Your letter will be included in the Final EA/FONSI.

Sincerely,

PBR HAWAII

Kimi Yuen
Associate

cc: Mr. Laurence K. Lau/OEQC
Mr. Donald Fujimoto/County of Kaua'i Department of Public Works
Mr. Douglas Haigh/County of Kaua'i DPW-Building

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LINDA LINGLE
GOVERNOR OF HAWAII

LAURA H. THIELEN
INTERIM CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

KEN C. KAWAHARA
DEPUTY DIRECTOR - WATER

AQUATIC RESOURCES
BOATING AND OCEAN RECREATION
BUREAU OF CONVEYANCES
COMMISSION ON WATER RESOURCE MANAGEMENT
CONSERVATION AND COASTAL LANDS
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HISTORIC PRESERVATION
KAHOOLAWE ISLAND RESERVE COMMISSION
LAND
STATE PARKS

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES

STATE HISTORIC PRESERVATION DIVISION
601 KAMOKILA BOULEVARD, ROOM 555
KAPOLEI, HAWAII 96707

September 13, 2007

Attn: Ms. Kimi Yuen, Associate
PBR Hawaii
1001 Bishop Street
ASB Tower, Suite 650
Honolulu, Hawaii 96813

LOG NO: 2007.2537
DOC NO: 0709AL15
Architecture
Archaeology

Dear Ms. Yuen:

SUBJECT: **Department of Health Draft Environmental Assessment (DEA) Review**
Pursuant to EIS Law (Hawai'i Revised Statutes, Chapter 343)
Pursuant to EIS Rules (Administrative Rules, Title 11, Chapter 200)
Līhue Civic Center Site Improvements Master Plan
Lihue, Kauai Island
TMK: 3-6-05:01, 02, 03, 06, 11, 27, 28, 30 and Portions of Rice Street, Hardy Street, Eiwa Street, 'Umi Street, Kūhiō Hwy., Kaumuali'i Hwy.

Thank you for your submittal, received August 10, 2007 at our O'ahu Office. The project proposal, entitled *Līhue Civic Center Site Improvements Master Plan: Draft Environmental Assessment*, details improvements to the 16-acre site of the historic town Civic Center. The site area includes the boundaries of the Līhue Civic Center Historic District, listed on the State (9/21/81) and National Registers of Historic Places (12/7/81) for its architectural and political significance. Contributing members of the historic district include the City Building, City Building Annex, City Courthouse, and adjacent park.

The SHPD's Historic Site Review concurs with a determination of FONSI (Finding of No Significant Impact) regarding the submitted proposal. Because the site in question consists of heavily urbanized land, there is no anticipated impact on known archaeological resources. Furthermore, the proposed improvements do not adversely affect any historic structures, listed or otherwise. The SHPD's only recommendation is that new plantings not obstruct the immediate visual vista of the primary façades of the listed buildings.

LOG NO: 2007.2537
DOC NO: 0709AL15

Thank you for the opportunity to consult on this project. Should you have any further architectural questions or concerns please contact Dr. Astrid Liverman in our O'ahu office at (808) 692-8032. Regarding archaeological matters, please contact Nancy McMahon in Kaua'i at (808) 742-7033.

Aloha,

Melanie A. Chinen, Administrator
State Historic Preservation Division

AMBL:jen

c: Dept of Public Works, Kauai, 444 Rice St, Suite 175, Līhu'e, Hawai'i 96766,
Attn: Mr. Douglas Haigh, Building Division Chief
Dept of Public Works, Kauai, 444 Rice St, Suite 275, Līhu'e, Hawai'i 96766,
Attn: Mr. Donald Fujimoto, County Engineer
Office of Environmental Quality Control, 235 South Beretania Street, Suite 702,
Honolulu, Hawai'i 96813

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Tel: (808) 242-2878

September 20, 2007

Ms. Melanie Chinen, Administrator
DLNR-State Historic Preservation Division
601 Kamokila Boulevard, Room 555
Kapolei, Hawai'i 96707

RE: Līhu'e Civic Center Site Improvements Master Plan
Draft Environmental Assessment, Līhu'e, Kaua'i, Hawai'i
(Log No: 2007.2552, Doc No. 0707NM39)

Dear Ms. Chinen:

Thank you for your second letter dated September 13, 2007 regarding the Draft Environmental Assessment (EA) for the Līhu'e Civic Center Site Improvements Master Plan. We acknowledge your comment that SHPD's Historic Site Review concurs with a determination of Finding of No Significant Impact (FONSI) and that there is no anticipated impact on known archaeological resources because the site consists of heavily urbanized land.

We also recognize your comment that the proposed improvements do not adversely affect any historic structures listed or otherwise. We will add the following text to the end of the second paragraph in Section 5.1.2 of the EA:

> Care will also be taken during the design and installation of the site improvements that no new plantings will obstruct the immediate visual vista of the primary façades of the historically listed buildings.

Thank you for your comments and for reviewing the Draft EA. Your letter will be included in the Final EA/FONSI.

Sincerely,

PBR HAWAII

Kimi Yuen
Associate

cc: Mr. Laurence K. Lau/OEQC
Mr. Donald Fujimoto/County of Kaua'i Department of Public Works
Mr. Douglas Haigh/County of Kaua'i DPW-Building

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Appendix A

Traffic Impact Analysis Report
County of Kauai
Department of Public Works
Lihue Civic Center Master Plan

Lihue, Island of Kauai, Hawaii

OCTOBER 2005

Prepared for:
PBR Hawaii
American Savings Bank Tower, Suite 650
1001 Bishop Street
Honolulu, Hawaii 96813

Prepared by:

M&E Pacific, Inc.

METCALF & EDDY

Davies Pacific Center, 841 Bishop Street
Suite 1900, Honolulu, Hawai'i 96813

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TRAFFIC IMPACT ANALYSIS
for the
COUNTY OF KAUAI DEPARTMENT OF PUBLIC WORKS
LIHUE CIVIC CENTER MASTER PLAN

I. PURPOSE OF STUDY

The County of Kauai Department of Public Works is developing a master plan for its Lihue Civic Center, a two block area in central Lihue bounded by Rice Street, Kuhio Highway, Hardy Street and Umi Street. This master plan represents a renewed commitment to revitalize the Lihue Civic Center, creating a pedestrian-friendly town center where workers, residents and visitors could enjoy civic activities and walk to nearby shops and businesses, as an example for all of Kauai. The County engaged PBR Hawaii to develop and evaluate various concepts of site improvements for the Lihue Civic Center, based on input from government, business and community representatives, then recommend a final master plan. M&E Pacific, Inc., was subcontracted to evaluate the traffic impacts of the conceptual, preliminary and recommended master plans. A location map of the project site is provided as **Figure I-1**.

This study was initiated in the fall of 2003 and proceeded concurrently with the County Planning Department's Lihue Town Core Urban Design Plan conducted by PBR Hawaii. Its scope and effort involved a wider area of Lihue town, including the Civic Center, and many planning efforts were coordinated to ensure consistency. The traffic forecasts for this latter study were not available at the time of this study and were not incorporated into this study. However, the findings and recommendations from this study will be incorporated into the traffic study prepared for that project.

This report identifies the current and future traffic conditions for the Lihue Civic Center with the recommended master plan. Chapter II describes current traffic conditions. Chapter III reviews and analyzes conceptual and refined alternatives that were

developed with input from the various stakeholders. Chapter IV discusses alternative traffic solutions for the preferred master plan. Chapter V summarizes the traffic-related recommendations for the final recommended master plan.

II. REVIEW OF CURRENT TRAFFIC CONDITIONS

The Lihue Civic Center is a two block area in central Lihue bounded by Rice Street, Kuhio Highway, Hardy Street, and Umi Street. A plan of the current Civic Center is shown on **Figure II-1**. M&E Pacific, Inc., conducted a survey of existing roadway and traffic conditions within the study area in October 2003.

A. Roadways

The roadways encompassing the Lihue Civic Center include Kuhio Highway on the west, Rice Street on the south, Hardy Street on the north and Umi Street on the east. Eiwa Street separates the civic center into an east block that includes the County and State buildings, and a west block with the Lihue Civic Center Building, some commercial offices, and a super market.

Kuhio Highway is a four-lane highway whose name changes to Kaumualii Highway south of its intersection with Rice Street. It provides north-south access through Lihue from the rest of the island and is under the jurisdiction of the State of Hawaii Department of Transportation (State DOT). On-street parking is not permitted on Kuhio Highway within the study area.

Rice Street was recently improved to a four-lane roadway. It provides east-west access on the south boundary of the Civic Center. The eastbound lanes have several off-line parking stalls (that do not block traffic flow) between Haleko Street and Eiwa Street, and several on-street stalls between Eiwa Street and Umi Street. The westbound lanes have several on-street stalls west of Eiwa Street. On-street parking is permitted during off peak periods that effectively limit Rice Street to one travel lane in each direction.

Peak parking bans are in effect from 7:00 to 9:00 A.M. and from 3:00 to 5:00 P.M. that allow two lanes of travel. The County placed traffic delineators in early October 2003 on the center line of Rice Street between Eiwa Street and Haleko Street to prevent left turns into several buildings along Rice Street due to accident experience.

Rice Street provides continuous access from the Kuhio Highway/Kaumualii Highway intersection to east of the study area. The Kuhio Highway/Kaumualii Highway and Umi Street intersections are controlled by traffic signals within the study area. All of the other side street approaches intersecting Rice Street are controlled by stop signs, including Haleko Street, Kele Street, Eiwa Street and Waa Street. There are no stop sign controlled approaches on Rice Street within the study area.

Hardy Street is a two-lane roadway that provides east-west access on the north boundary of the civic center. On street parking is permitted on both sides of the street. There is a sidewalk on the north curb and painted shoulders or an asphalt berm on the south curb. The roadway curb-to-curb width varies from 40' to 50' and can be poorly defined on the south curb. Hardy Street provides limited access to private driveways on the north curb and to the Lihue Civic Center and State Building parking lots on the south curb.

Hardy Street provides continuous access from the Kuhio Highway intersection to its intersection with Rice Street east of the study area. All of the side street approaches intersecting Hardy Street are controlled by stop signs, including Akahi Street, Eiwa Street, Elua Street, Umi Street and Ka'ana Street. There are no stop sign controlled approaches on Hardy Street within the study area.

Umi Street and Eiwa Street are two-lane local roads that provide north-south access between Rice Street and Hardy Street, and access to the Civic Center parking lots. Both streets permit on-street parking and have painted shoulders. Umi Street continues north from Hardy Street to Ahukini Road as a local residential roadway.

Haleko Street is a two-lane roadway providing access between Rice Street and the Kukui Grove Center. The northbound approach at Rice Street is restricted to right turns only. Kele Street is a short two-lane roadway off Rice Street providing access to the post office, Lihue Plantation Building and banks. Akahi Street and Elua Street are two-lane local residential roadways between Hardy Street and Ahukini Road.

B. Traffic Volumes

Traffic turning movement counts were taken at all major and most minor intersections and driveways in the study area to determine the existing traffic patterns around the Civic Center during the morning and afternoon peak periods. The counts were taken during the same time periods as the peak parking restrictions. Traffic turning movement counts require traffic surveyors to station themselves by each study intersection and record each vehicle movement as through or turning movements by 15 minute intervals. Full traffic counts were taken from late September to mid-October 2003, at the following intersections and dates:

- Rice Street at Kuhio Highway/Kaumualii Highway (October 1. 2003)
- Rice Street at Haleko Street (October 14, 2003)*
- Rice Street at driveway entry to Lihue Civic Center (October 2, 2003)
- Rice Street at Eiwa Street (September 30, 2003)
- Rice Street at Umi Street (October 7, 2003)*
- Hardy Street at Kuhio Highway September 25, 2003)
- Hardy Street at Akahi Street (September 23, 2003)
- Hardy Street at Eiwa Street (September 24, 2003)
- Hardy Street at Umi Street (October 8, 2003)*

Those counts identified by an asterisk (*) were taken after plastic delineators were placed on Rice Street. Partial traffic counts of turning movements only were taken at the two Eiwa Street driveway entrances to the Lihue Civic Center on October 9, 2003,

after the traffic delineators were placed. The several entrances to the County and State Building parking lots (east of Eiwa Street) were counted as one driveway.

Additional traffic counts were subsequently taken in December 2004 at the following locations and dates as issues arose and emphasized the need for this information:

- Rice Street at Kele Street (December 16, 2004)
- Hardy Street at Big Save Driveway (December 14, 2004)
- Kuhio Highway at County/Big Save Driveway, AM peak only (December 10, 2004)
- Umi Street at State/County driveway (December 15, 2004)

The worksheets for the traffic counts are included in **Appendix A**. The results of the traffic counts are shown schematically on the attached **Figure II-2A** for the A.M. peak hour and **Figure II-2B** for the P.M. peak hour (hereafter referred collectively as **Figure II-2**). The volumes for several through traffic movements on Eiwa Street and Hardy Street that were not counted were derived from differences in traffic counts at adjacent intersections and are identified by shading. The traffic volumes are rounded to the nearest five vehicles per hour (vph).

The morning peak hour was observed to be between 7:15 and 8:15 A.M. This is within the limits of the current morning parking ban. The afternoon peak hour was between 4:00 and 5:00 P.M., when the counts were terminated. Based on the trends in the 15 minute traffic volumes, there is reason to believe that the peak extends beyond 5:00 P.M. The County should undertake additional studies to determine if the afternoon parking ban should be extended to 5:30 P.M.

A high peaking pattern was noted in these traffic counts. The highest traffic volumes occurred between 7:30-7:45 A.M. and 4:30-4:45 P.M., which are the County's official start and end work times. This peaking is characterized by the traffic Peak Hour Factor (PHF) values that are generally lower than 0.90. A PHF value less than 0.90 indicates

that traffic volumes in one 15-minute interval of the peak hour is significantly higher than the other intervals.

The State DOT takes metered traffic counts at selected locations on Kauai roadways every two years. One of these count stations is at the Kuhio Highway/Kaumualii Highway/Rice Street intersection. Their data shows that two way daily volumes on Kuhio Highway gradually increased from 1991 to 1995, remained steady to 1999, increased in 2001 and leveled off in 2003. This traffic trend is shown in tabular and graph form on **Figure II-3**. The two counts taken in October 2001 after the September 11, 2001, World Trade Center incident show daily volumes of 24,500 and 29,300 (not shown in **Figure II-3**), a difference of almost 5,000 vehicles per day. The 2003 count was taken after the commencement of Operation Iraqi Freedom in March.

The daily traffic volumes on Kaumualii Highway increased steadily to 1999 and have remained at about the same level. The two October 2001 daily count volumes were the same, unlike the Kuhio Highway counts that differed significantly. The volumes on Rice Street steadily decreased up until 2001 and then increased in 2003 but remained below pre-1999 levels. These traffic trends are also shown on **Figure II-3**.

The state data also includes hourly traffic volumes through the course of the day in 2003, as shown on **Figure II-4**. The southbound hourly volumes on Kuhio Highway peaked at 7:00 A.M. with 960 vph, then after a two hour gap, remained at about that level until 5:00 P.M. The northbound volumes show a small peak at 7:00 A.M., then after a two hour gap, gradually increased to a higher peak at 3:00 P.M. The eastbound traffic on Rice Street reached a peak of 470 vph at 7:00 A.M., then remained at about 400 vph until 5:00 P.M. The westbound traffic show morning, midday and afternoon peaks. These two roadways do not exhibit the typical hourly pattern of a commuter roadway with a morning peak in one direction and an afternoon peak in the other direction, indicating that these two roadways serve a business district.

The current afternoon peak hour traffic volumes were compared to the volumes reported in the Kauai County Office Complex Traffic Impact Analysis Report (November 1989) prepared by Pacific Planning and Engineering, Inc. In general, the current traffic volumes on Rice Street, Eiwa Street, and Hardy Street are equal to or lower than the 1989 volumes while traffic volumes on Kuhio Highway have increased. This finding corresponds to the trends noted on the State DOT biennial traffic counts above.

A separate parking survey of Civic Center occupants was conducted by PBR Hawaii to determine the demand for parking. The surveyed occupants included County and State offices in the Civic Center, the Kauai Museum and the super market. The survey methodology and results are not included in this report.

C. Traffic Accident Analysis

A traffic accident analysis was conducted on the five (5) roadways in the study area for the 18 month period from July 2001 to December 2002. This was the latest period for which these records were available when they were requested from the State of Hawaii Department of Transportation at the start of this study. Rice Street was under construction for part of this time. There were only a limited number of accidents that did not indicate any major traffic problems during this period. The accident experience that caused the placement of traffic delineators on Rice Street occurred after the data period.

D. Level of Service

The concept of level of service is used to quantify the quality of traffic flow on roadway facilities. The Transportation Research Board has developed procedures to calculate level of service value(s) by measuring traffic volumes against the capacities of different types of roadway facilities. Their Highway Capacity Manual 2000 (HCM2000) describes the various procedures developed for freeways, highways, signalized and unsignalized intersections, etc. The existing traffic volumes from **Figure II-2** were used to calculate

current levels of service. The worksheets for the level of service analysis are included in **Appendix B.**

The methodology for analyzing signalized intersections calculates the levels of service for individual approaches and the intersection as a whole based on the average stopped delay per vehicle. The results range from level of service A (best with average delays less than five seconds) to F (worst with average delays longer than 80 seconds, described as follows:

LEVEL OF SERVICE	CONTROL DELAY PER VEHICLE (Seconds/Vehicle)
A	<10.0
B	10.1 to 20.0
C	20.1 to 35.0
D	35.1 to 55.0
E	55.1 to 80.0
F	>80.0

Many jurisdictions consider levels of service A to D as acceptable for areas like Lihue, with levels of service E and F indicating the need for mitigating measures. For signalized intersections, the major streets can be designed to have a higher level of service than the side streets or turning lanes.

The results of the level of service analyses on **Table II-1** show that both signalized intersections are operating at an overall level of service B during both peak periods. At the Kuhio Highway/Kaumualii Highway/Rice Street intersection, the westbound left turn movement from Rice Street to Kaumualii Highway is operating at level of service D, a minimally acceptable level, in both periods while the northbound and southbound movements on the highways are at levels A or B. The difference in levels of service is in accordance with general practice to favor the major street traffic flow. All traffic

movements at the Rice Street/Umi Street intersection are at level of service C or better, indicating acceptable traffic conditions.

The procedure used for analyzing unsignalized intersections calculates vehicle delays and levels of service for critical turning movements including outbound movements from the stop-controlled approach and left turns from the main road to the minor road. The procedure does not calculate an overall intersection level of service. The Highway Capacity Manual defines the relationship between level of service and delay (in seconds/vehicle) for unsignalized intersections as shown below:

LEVEL OF SERVICE	DELAY (Seconds/Vehicle)
A	< 10.0
B	10.1 to 15.0
C	15.1 to 25.0
D	25.1 to 35.0
E	35.1 to 50.0
F	> 50.1

Levels of service A to E are considered acceptable for unsignalized intersections. Level of service F (with average delays longer than 50 seconds) is considered undesirable and would indicate the need for mitigation. Level of service F conditions could be tolerated if the delays are not much higher than 50 seconds, traffic queues are short, and there are no reasonable mitigating measures available.

The results on **Table II-1** show that several left turn movements from the side streets are operating at level of service F, indicating very long delays and the possible need for mitigation. These movements include southbound Eiwa Street onto Rice Street, westbound Hardy Street onto Kuhio Highway, and northbound Umi Street onto Hardy Street. The left turn from Hardy Street onto Kuhio Highway is particularly difficult to make and is characterized with delay times over 100 seconds. The left turns from Umi

Street onto Hardy Street are made into congested local traffic. Drivers on Hardy Street let in the left turners from Umi Street so that their wait may not be as long as the calculations indicate.

A level of service F not only means long delays but could also indicate a hazardous traffic situation as drivers become impatient, take their chances and make their turns into smaller than acceptable gaps in the main traffic stream. This is particularly the case with the left turn from Hardy Street onto Kuhio Highway. For the southbound Eiwa Street left turn onto Rice Street and the westbound Hardy Street left turn onto Kuhio Highway, longer alternate routes could be used to get to a signalized intersection where the turn could be more safely made.

The Haleko Street right turn movement onto Rice Street shows level of service E for both peak periods. This would indicate current minimally acceptable conditions that could require mitigation in the future as traffic on Rice Street increases.

Level of service alone is not always sufficient to evaluate the efficiency of left turn movements from major streets, especially when the movement is made from a shared traffic lane. As an example, traffic backups were forming on Rice Street between Haleko and Eiwa Streets due to large volumes of left turns being made into several office buildings, until the plastic delineators were placed in early October 2003. The levels of service for the left turn movement from Rice Street into Haleko Street were B and C, which would normally be considered acceptable but does not indicate the traffic queuing that was taking place. Average delays and queue length can give a better indication of the disruption that may be caused to through traffic movements. These measures will be given further study.

III. REVIEW OF TRAFFIC ISSUES RELATED TO PRELIMINARY ALTERNATIVES

Four conceptual alternatives were initially developed by PBR Hawaii and evaluated with input from government, business and community representatives. This evaluation resulted in two refined alternatives that were further evaluated and led to the final alternative. This section describes the distinguishing features of the preliminary alternatives and the results of the qualitative traffic analysis conducted by M&E Pacific, Inc.

A. Development of Conceptual Alternatives

The highlights of the initial four conceptual alternatives are described below.

Conceptual Alternative 1- Minimal Construction Demolition

This concept is illustrated on **Figure III-1**. Its distinguishing features include:

- Minimal construction and demolition.
- Provides 485 parking stalls in County area and 224 stalls at War Memorial to meet demand for 559 stalls.
- Traffic roundabout at Hardy Street/'Akahi Street/Eiwa Street intersection.
- Pedestrian promenade from Mo'ikeha Building to County Lawn.
- Tree lined streets with sidewalks.
- On street parking with lots of pavement.
- Lowest cost alternative.
- State property unchanged except for elimination of one driveway on Eiwa Street.

Conceptual Alternative 2- Grand Park Along Rice Street and Parking Structure at War Memorial

This concept is illustrated on **Figure III-2**. Its distinguishing features include:

- 400 stall parking structure at War Memorial.
- Provides 227 parking stalls in County area and 400 stalls at War Memorial to meet demand for 559 stalls.

- Traffic roundabout at Hardy Street/'Akahi Street/Eiwa Street intersection.
- Pedestrian promenade from Mo'ikeha Building to County Lawn.
- Expanded County Lawn and new mini-parks.
- Tree lined streets with sidewalks.
- On street parking.
- Regular, frequent shuttle runs between Civic Center, War Memorial, New Police Station, and Kukui Grove Shopping Center.
- Moderate cost alternative.
- State property unchanged except for elimination of one driveway on Eiwa Street.

Conceptual Alternative 3- Campus-Like Setting and Below Grade Parking

This concept is illustrated on **Figure III-3**. Its distinguishing features include:

- Two below grade parking garages with a total of 326 stalls and park above.
- Provides 379 on site parking stalls and 224 stalls at War Memorial to meet demand for 474 stalls.
- Traffic roundabout at Hardy Street/'Akahi Street/Eiwa Street intersection.
- Pedestrian promenade from Mo'ikeha Building to County Lawn.
- Big Save relocated off site.
- Eiwa Street closed to through traffic, only parking access permitted.
- Tree lined streets with sidewalks.
- On street parking.
- Moderate cost alternative.
- State property unchanged except for elimination of one driveway on Eiwa Street.

Conceptual Alternative 4- Urban Mixed Use Civic Center and Two parking Structures

This concept is illustrated on **Figure III-4**. Its distinguishing features include:

- Two 3-level parking structures with a total of 450 stalls, 26,500 gsf retail space and 22 multi-family units fronting public streets.

- Provides 605 on site parking stalls and 224 stalls at War Memorial to meet demand for 694 stalls.
- Expanded County Lawn with new plazas and mini-parks.
- Tree lined streets with sidewalks.
- On street parking.
- Considerable cost, long-term scenario.
- State property unchanged except for elimination of one driveway on Eiwa Street.

B. Traffic Analysis of Conceptual Alternatives

A qualitative traffic analysis of each of the four conceptual alternatives was conducted by M&E Pacific, Inc., to provide input to the evaluation teams. The comments are based on current traffic volumes since a traffic forecast year was not established at the time of this analysis. Specific comments on each alternative are provided below.

Conceptual Alternative 1- Minimal Construction/Demolition

1. There should be very little changes in existing traffic patterns. There probably will not be a slight decrease in traffic volumes with the transfer of some vehicles to the War Memorial parking lot since other vehicles would serve as informal "shuttles." The proposed roundabout would probably not affect traffic patterns.

2. Consider banning left turns from Hardy Street to Kuhio Highway at least in peak periods, preferably 6 a.m. to 6 p.m. weekdays, if traffic signals are not installed. Left turns would be made at Rice Street via Eiwa Street.

3. If left turns from Rice Street remain prohibited between Eiwa Street and Haleko Street, then the entrance to the south parking lot should be right turn in/out only.

Conceptual Alternative 2- Grand Park Along Rice Street and Parking Structure at War Memorial

1. Large changes in traffic patterns can be expected. There would be more eastbound and less westbound traffic in the morning, and vice versa in the afternoon. There would probably be more traffic on Umi Street between Hardy Street and Ahukini Street, a residential street. There would also be a greater impact on the Hardy Street/Umi Street intersection, which may require traffic signals. There would be an impact at the Rice Street/Hardy Street intersection, which was not studied.

2. Assigning "close-in, preferred" parking will be a difficult task. Big Save and Museum will probably take most of stalls. County customers may experience longer walks to County offices.

3. Shuttle service will have to be frequent to be useful to its users. Having the shuttle go to Kukui Grove Shopping Center may reduce lunch time vehicle traffic, if it provides a convenient service.

4. Consider banning left turns from Hardy Street to Kuhio Highway at least in peak periods, preferably 6 a.m. to 6 p.m. weekdays, if traffic signals are not installed. Left turns would be made at Rice Street via Eiwa Street.

Conceptual Alternative 3- Campus-Like Setting and Below Grade Parking

1. There would be a significant shift in traffic from Rice Street to Hardy Street. Hardy Street would need to be improved for the additional traffic. Traffic signals would be required at the Hardy Street/Kuhio Highway intersection, since left turns onto Kuhio Highway would be required.

2. Entries into parking garage would have to be designed so that inbound queues do not back up into through traffic. Entry from Rice Street should be right turn

in/out during peak periods, and preferably 6 a.m. to 6 p.m. weekdays if left turn ban is lifted. Otherwise, it would right turn in/out only.

3. Removal of Big Save would reduce traffic and parking needs during midday and afternoon periods.

Conceptual Alternative 4- Urban Mixed Use Civic Center and Two Parking Structures

1. Traffic from the Civic Center would not be significantly affected. There would be more traffic on Hardy Street between Akahi Street and Eiwa Street due to the removal of the Hardy Street entrance. Some additional traffic would be generated by the proposed retail and multi-family units.

2. Consider banning left turns from Hardy Street to Kuhio Highway at least in peak periods, preferably 6 A.M. to 6 P.M. weekdays, if traffic signals are not installed. Left turns would be made at Rice Street via Eiwa Street.

3. If left turns from Rice Street remain prohibited between Eiwa Street and Haleko Street, then the entrance to parking lot south of the Piikoi Building would be right turn in/out only.

C. Development of Refined Alternatives

Two refined alternatives were developed by PBR Hawaii following the evaluation of the conceptual alternatives. The distinguishing features of each refined alternatives are described below.

Refined Alternative 1

This concept is illustrated on **Figure III-5**. Its distinguishing features include:

- Two level, 250 stall parking structure off Hardy Street.

- Provides 462 parking stalls in County area and 224 stalls at War Memorial to meet demand of 569 stalls. On-site parking would be short by 10-20 vehicles if County cars and voluntary off-site vehicles park at War Memorial.
- Eiwa Street realigned at Hardy Street to intersect with Akahi Street.
- Realign super market entry toward Eiwa Street, and renovate facades.
- Pedestrian promenade from Mo'ikeha Building to historic County Building.
- New park surrounding Kauai Museum.
- Sidewalk improvements on all streets.
- On street parking where safe and feasible.
- Regular, frequent shuttle runs between Civic Center, War Memorial, New Police Station, and Kukui Grove Shopping Center.
- State property unchanged except for elimination of one driveway on Eiwa Street.

Refined Alternative 2

- Grand park along Rice Street with landscaping and beautification features.
- Eiwa Street closed and made into pedestrian promenade.
- Pedestrian promenade from Mo'ikeha Building to historic County Building.
- Develop shared parking facilities with the State. Depending on the feasibility to build joint parking facilities and number of stalls allocated to the County, another parking structure could be developed at the War Memorial. Improve pedestrian paths to the Civic Center.
- Provides up to 415 County parking stalls and 400 stalls at War Memorial to meet demand of 569 stalls.
- Traffic roundabout at Hardy Street/Umi Street intersection.
- Regular, frequent shuttle runs between Civic Center, War Memorial, New Police Station, and Kukui Grove Shopping Center.
- Reduced on street parking, allow public parking in parking structures if feasible.

D. Traffic Analysis of Refined Alternatives

A qualitative analysis of each of the two refined alternatives was conducted to provide input to the evaluation teams. The comments are based on current traffic volumes

since a traffic forecast year was not established at the time of this analysis. Specific comments on each alternative are provided below.

Refined Alternative 1

1. The traffic circulation plan for this alternative would be very similar to the existing plan. Most of the roadways and parking lot access points remain the same. Large changes in traffic volumes should not be expected. The one major difference is the reduction in number of stalls in the south parking lot from about 155 to 52 stalls. This difference was assumed to be assigned to the War Memorial parking lot. This change would have a minor impact on Rice Street in that there would be an increase in eastbound traffic and decrease in westbound traffic in the morning, and vice-versa in the afternoon. The proposed parking structure in the north lot would have the about the same number of stalls as the existing lot it would be built on, so that there should not be major changes in the traffic patterns on Hardy Street.

2. The distance of the parking lot entrance/exit on Hardy Street from the Kuhio Highway intersection is a concern. Currently, afternoon traffic occasionally backs up to the existing driveway and this can be expected with the proposed plan. A traffic signal with a short cycle length would help keep queue lengths short. A long cycle length would create long queues that could back up to the driveway.

3. A traffic signal is probably warranted at the Kuhio Highway/Hardy Street intersection. The State DOT would have to be involved in this study also. If a signal is installed at this location, it should be interconnected with the existing signals on Kuhio Highway, a State roadway.

4. Realigning Eiwa Street to meet Akahi Street would create several problems. The realigned Eiwa Street would have a tight horizontal curve that should be checked for feasibility. Assuming that all intersection approaches are one lane as is the

current design, and with the existing traffic volumes, both side street approaches would be level of service E in the morning peak and level of service F in the afternoon peak. This is because four approach intersections have more conflict potential than the existing three approach (T) intersection. Also, level of service calculation programs are not able to account for the traffic interruptions at closely-spaced T-intersections, such as Akahi and Eiwa Streets with Hardy Street, so they could calculate better levels of service than is actually occurring. The queues on the realigned Eiwa Street are expected to be about 16 vehicles long in the afternoon, or over 300 feet, with the two way stop. This length would block the access to the State office building. It would be difficult to widen the Akahi Street (southbound), although the realigned Eiwa Street approach could be made into two lanes to mitigate the poor levels of service on Eiwa Street.

This problem could be mitigated by installing a four way stop and widening Hardy Street to four lanes. The intersection would operate at level of service B in the both the morning and afternoon peak periods. The intersection would operate at level of service E in the afternoon if Hardy Street is not widened to four lanes. The roadway widening would eliminate any on-street parking on Hardy Street.

Refined Alternative 2

1. Extensive design changes have been proposed to the system of parking lots. However, there would not be much change in the usage of the lot north of Piikoi building/Big Save and the lot between the historic County Building and State Office Building since the number of stalls would be similar to existing inventory. The change in access points to these lots would affect traffic by concentrating traffic at two points: Hardy Street at Akahi Street, and new local roadway and Umi Street. The former intersection would have to be signalized since a stop controlled approach would operate at level of service F and queue lengths would exceed 100 feet. A very short cycle length would be needed to keep queues under 100 feet.

The parking makai of the Piikoi building would be reduced from 157 to 59 stalls, and the 61 stalls north of Big Save would be eliminated. These changes would reduce the volume of traffic entering these areas. A new shared State/County parking structure on the site of the former police station would increase traffic on Umi Street. The parking structure at the War Memorial site would divert traffic from the immediate Civic Center area.

2. The closure of Eiwa Street would divert more traffic to the remaining streets and add more volume to the turning movements at the Kuhio Highway/Hardy Street, Hardy Street/Umi Street and Rice Street/Umi Street intersections.

   The Kuhio Highway/Hardy Street intersection is already at level of service F in both peak hours due to the difficulty in making the left turn from Hardy Street. This intersection would have to be signalized since it would be difficult to ban the left turn movement in the peak periods since the Eiwa Street connection would be lost.

   A roundabout has been proposed at the Hardy Street/Umi Street intersection to accommodate the additional traffic. There should not be any operational problem with this concept. A 120' diameter roundabout design should be adequate for the travel speeds and volumes expected.

   The existing traffic signal at Rice Street/Umi Street should be able to adequately handle traffic, although the inside eastbound approach of Rice Street would serve as a default left turn lane. During the P.M. peak hour, the right turn movement on the southbound approach of Umi Street would operate at level of service D.

3. The new proposed local roadway between Umi Street and the Akahi Street extension would serve as access points into several parking areas. This roadway should be designed as a low speed roadway to discourage through traffic on it. The median in the roadway could serve as a left turn lane so that these vehicles do not block through vehicles.

IV. TRAFFIC ANALYSIS OF RECOMMENDED PLAN

This section recommends traffic improvements required around the Lihue Civic Center to accommodate the recommended master plan. The study forecast future traffic patterns for ambient and the recommended master plan conditions. Future traffic patterns were based on the proposed redesign of the parking lot. Future traffic conditions were analyzed based on levels of service and delay at major intersections and driveways. Recommendations for roadway improvements were based on the analysis.

A. Elements of Recommended Master Plan

The recommended master plan developed by PBR Hawaii is shown on **Figure IV-1**. The highlights of the recommended master plan are described below.

- New Central Park east the Piikoi Building and expanded County lawn along Rice Street.
- Tree-lined pedestrian promenade connecting Piikoi Building and Historic County Building.
- Two 2-level parking structures north and east of the Piikoi Building with approximately 290 stalls. Other parking areas would be redesigned.
- A total of 535 parking stalls in County parking areas and up to 400 stalls at War Memorial if a parking deck is added above the existing parking lot to meet future demand. Onsite State parking areas lose one stall for a total of 144 stalls
- Eiwa Street closed and a new spine access road built from Umi Street to Hardy Street. The new roadway approach would create a four-way intersection with Akahi Street and Hardy Street.
- Driveway to parking area south of Piikoi Building relocated directly across Kele Street.

- Traffic roundabout at Hardy Street/Umi Street intersection.
- Regular, frequent shuttle runs between Civic Center, War Memorial, New Police Station, and Kukui Grove Shopping Center.
- Striped bicycle lanes on Hardy Street and Umi Street, with bicycle routes on Kuhio Highway and Rice Street.

B. Traffic Forecasting Methodology

Ten year traffic forecasts were prepared for the weekday A.M. and P.M. peak hours. In addition to the traffic forecast for the recommended plan, two sets of ambient forecasts were analyzed. Ambient Scenario 1 representing the "no-build" condition assumed the current roadway conditions and the anticipated opening of the Ka'ana Street extension, which would create a new travel path between Hardy Street and Kapule Highway. Ambient Scenario 2 assumed Scenario 1 conditions and the installation of traffic signals at the Kuhio Highway/Hardy Street intersection, since the analysis indicated that it is needed and would create some traffic pattern changes within the Civic Center.

Existing traffic volumes are summarized on **Figure II-2A** for the A.M. peak and **Figure II-2B** for the P.M. peak. The traffic patterns were then divided into two components: the traffic leaving and entering the Civic Center parking lots and the traffic passing through the study area.

The existing traffic patterns of parking lot traffic were derived in two steps. First, travel paths entering and leaving the parking lots were estimated to obtain origins and destinations of these vehicles in the study area. Then these travel paths were adjusted to account for the expected opening of Ka'ana Street. The resultant traffic assignments of parking lot trips are shown on **Figure IV-2**. It was assumed that these traffic volumes would remain constant for the ambient traffic forecasts since the number of users are currently near capacity and the number of parking stalls would not change by much with the master plan design.

The parking-related traffic assignments from **Figure IV-2** were subtracted from the current traffic patterns from **Figure II-2**. The remaining traffic was assumed to be the through traffic in the study area. This existing through traffic pattern was then adjusted for the opening of the Ka'ana Street extension to obtain the traffic assignment shown on **Figure IV-3**. This traffic assignment pattern was used in Ambient Scenario 1. The **Figure IV-3** through traffic forecast was then adjusted to account for the installation of traffic signals at the Kuhio Highway/Hardy Street intersection, to obtain the **Figure IV-4** traffic assignment used in Ambient Scenario 2. The primary impact of installing this traffic signal would be the diversion of trips from Eiwa Street and Rice Street to Hardy Street and Kuhio Highway.

The two ambient through traffic volumes patterns from **Figures IV-3** and **IV-4** were increased by 20% in both study peak hours to obtain the future through traffic volumes for each scenario. The 20% growth rate is based on the analysis of existing and traffic forecast data in the Kauai Long Range Land Transportation Plan (1997) prepared by Austin Tsutsumi and Associates, Inc. The volumes of trips entering and leaving Kele Street were not increased by 20% but were assumed to remain constant. The through traffic forecast for Ambient Scenario 1 is shown on **Figure IV-5** and for Ambient Scenario 2 on **Figure IV-6**. These forecasts do not account for the traffic changes that would take place with the proposed widening of Kaumualii Highway from Lihue to Puhi or the implementation of the Lihue Bypass Road. These issues will be addressed in the Lihue Town Area Urban Design Plan traffic study.

The existing morning and afternoon peak hour traffic patterns for Civic Center parking from **Figure IV-2** was added to the Ambient Scenario 1 through traffic forecasts from **Figure IV-5** to obtain the combined Ambient Scenario 1 traffic forecasts shown on **Figure IV-7**. In the same manner, the existing parking traffic assignments were added to the Ambient Scenario 2 through traffic forecasts from **Figure IV-6** to obtain the combined Ambient Scenario 2 traffic forecasts shown on **Figure IV-8**.

A similar procedure was used to calculate the traffic assignments with the master plan. The existing incoming and outgoing volumes were analyzed to obtain trip generation rates per parking stall for government-related trips in each peak hour. These unit rates were then used to forecast the hourly number of trips that would be generated from the various parking lot areas under the master plan. In addition, trip generation rates from the Institute of Transportation Engineers Trip Generation (7th Edition, 2003) were used to estimate the trips from the Big Save market. The trips generated by both calculations were then assigned to the roadway network around the Civic Center for the master plan as shown on **Figure IV-9**.

The current through traffic volumes from **Figure IV-3** were adjusted to account for the closure of Eiwa Street, and the resultant traffic assignments were used as the through trip pattern for the master plan scenario. The existing through traffic assignments with the master plan are shown on **Figure IV-10**. The existing through volumes were then increased by 20% to obtain the master plan through traffic forecast shown on **Figure IV-11**.

The master plan parking-related traffic assignments from **Figure IV-9** were added to the master plan through traffic forecasts from **Figure IV-11** to obtain the combined master plan traffic forecasts shown on **Figure IV-12**. The traffic circulation with master plan would further increase the volume of vehicles on Hardy Street relative to Ambient Scenario 2.

The traffic forecast volumes at each study intersection were analyzed for level of service and delay for the current (**Figure II-2**), two ambient forecast (**Figures IV-7** and **-8**) and master plan (**Figure IV-12**) scenarios, for both peak hours. The results are shown on **Table IV-1** with the results for the four scenarios as appropriate. Multiple alternatives were developed at several intersections for the master plan as a process of identifying mitigating actions. For signalized intersections, the level of service and average delay for the entire intersection and each approach are listed, with left turn lane

subapproaches (identified by an underline) included as appropriate. For unsignalized intersections with stops on the side streets, the side street and left turn from main street levels of service are listed. For all-way stop unsignalized intersections, the entire intersection and each approach statistics are given. For the intersection with a proposed roundabout, the volume/capacity (v/c) ratio is listed for each approach. To date because of the limited American experience with roundabouts, there is no correspondence of v/c with levels of service for roundabouts.

C. Traffic Analysis and Recommendations

Recommendations for traffic improvements based on the ten year traffic forecasts are listed by each intersection.

Rice Street

Rice Street was recently reconstructed as a four-lane roadway with left turns made from the inside through lanes. Parking is permitted on certain sections of the outside lanes in the off peak periods. Plastic delineators were placed on certain sections of Rice Street soon after completion of construction to prohibit left turns due to accident experience. The four-lane design would be sufficient in the future but permitting on-street parking during the day time off-peak periods would need to be studied closer. Further roadway improvements are being proposed under the Lihue Town Core Urban Design Plan.

The latest version of the Statewide Transportation Improvement Program: FY 2004 Thru FY 2006 (STIP) (Amendment #8, revised August 10, 2005,) lists the transportation improvement projects approved for funding in the listed fiscal years. Two projects are listed on Rice Street. The State DOT is currently designing the Kapule Highway/Rice Street intersection so that the through movement is from Kapule Highway to the Nawiliwili leg of Rice Street. The Lihue leg of Rice Street would become stop sign controlled. The funds for construction of the project are listed for Federal Fiscal Year

2006. This project could divert traffic using Rice Street and Haleko Street to access the Kukui Grove Shopping Center.

The STIP also lists the Rice Street/Nawiliwili Road Bikeway from Kaumualii Highway to Waapa Road. The design is listed for funding in Federal Fiscal Year 2004 and construction in Federal Fiscal Year 2005.

Rice Street/Umi Street

The current design and signalized operation of the Rice Street/Umi Street intersection would be adequate to meet traffic increases under the two Ambient Scenarios. The intersection would continue to operate at level of service D even with a 20% increase in through traffic. However, the volume of left turns from eastbound Rice Street into Umi Street would increase significantly with the recommended master plan due to the proposed closure of Eiwa Street. Although the signal would operate at level of service B in the A.M. peak and at C in the P.M. peak, the above left turn movement is forecast to operate at level of service E in the future P.M. peak hour. Although this level is generally considered undesirable for a signalized intersection, level of service E is sometimes tolerated for minor movements such as left turns when there are no feasible mitigating measures or if it helps maintain the main through movements at acceptable levels of service. The capacity analysis program also indicates that the left lane would operate as a default left turn lane. The eastbound approach would still operate satisfactorily with one through and one left turn lane.

Recommendation: Convert the left eastbound lane of Rice Street into an exclusive left turn lane by restriping. Create a three phase signal with a leading left turn and through phase for eastbound traffic. This may require new traffic signals to provide the mastarms required for leading turn phases. The left turn movement is forecast to operate at level of service D with these improvements.

Rice Street/Eiwa Street

This unsignalized intersection would be eliminated under the master plan's proposal to close Eiwa Street. The volume of right turns from Eiwa Street exceeds the volume of traffic egressing the parking lots. This implies that many drivers are using Eiwa Street as a shortcut to get to Rice Street to access Haleko Road or Kaumualii Highway. It is very difficult to make a left turn from Eiwa Street due to the heavy traffic volumes on Rice Street. This is indicated by the low volumes making this move and the poor levels of service calculated for the current and ambient conditions. There are also relatively heavy volumes of left turns into Eiwa Street from Rice Street during both peak periods. If the master plan were not implemented and Eiwa Street were maintained, the only way to mitigate this condition for the ambient scenarios would be to signalize the intersection, which then would then cause a major change in the traffic patterns.

Rice Street/Kele Street/County-Museum Driveway

Kele Street has high volumes for a side street due to the Post Office and businesses it serves. Its approach is currently operating at levels of service C in the morning peak (due to lower traffic volumes on the approach) and F in the afternoon peak, the latter is considered undesirable. In addition, it is difficult to make outbound left turns from Kele Street as indicated by the high proportion of right turns. Future increases in traffic on Rice Street would make the outbound movement more difficult and increase delay significantly.

The driveway for the County Building and Kauai Museum parking lot is located about 120 feet east and across the street from Kele Street. As with Eiwa and Kele Streets, the high volume of right turns and low volume of left turns from this approach indicates difficulty in making left turns. The master plan proposes to relocate this driveway westward to align directly across Kele Street. With this move, Kele Street and the County driveway approaches are forecast to continue operating at undesirable levels of service as an unsignalized intersection.

Recommendation 1: Restrict the traffic movements to right-turn in, right-turn out at these two approaches. The outbound right turn movements on both approaches are expected to improve to level of service B with this change.

Recommendation 2: As an alternative, signalize the intersection if right turn only restrictions are not acceptable. Traffic signals are barely warranted with the forecast volumes and the intersection is forecast to operate at level of service A in both peak periods. Pedestrian crossings would become safer with traffic signals.

Rice Street/Haleko Road

Left turn movements from Haleko Road onto Rice Street are currently not permitted. The outbound right turn movement is presently level of service E in both the A.M. and P.M. peaks. It is forecast to decline to an undesirable level of service F in both peak periods due to increases in through traffic on Rice Street and right turn traffic from Haleko Road. There is a heavy left turn movement from Rice Street unto Haleko Road during both peak periods. This movement is currently at level of service B in the A.M. peak and C in the P.M. peak. Although level of service C is generally considered acceptable, observations elsewhere indicate that level of service C for left turns from the main roadway can be difficult to make and could require mitigation.

A possible mitigating measure that was analyzed was to create two eastbound lanes on Rice Street, one through and one right turn lane. This would improve right turn operations from Haleko Road in the P.M. peak but would not help the A.M. peak. In addition, the level of service for the left turn movement from Rice Street would not be improved. Since there does not appear to be sufficient right-of-way to implement this alternative, it should not be given further consideration.

The Kauai Long Range Land Transportation Plan (1997) that is in the process of being updated recommends widening Haleko Road to four lanes from Nawiliwili Road to Rice

Street. Haleko Road would need to be widened to four lanes to adequately handle the traffic volumes forecast on it. There is also sentiment to retain the two-lane design of Haleko Road as a historic landmark. The widening of Kaumualii Highway from Lihue to Puhi is currently under design. The STIP lists the Right-of-Way acquisition for the Phase 1 widening of Kaumualii Highway from Lihue to Puhi in Federal Fiscal Year 2005.

When the latter is implemented, the need to widen Haleko Road would be minimized. Therefore, the following recommendations are based on whether or not Haleko Road is widened.

Recommendation 1: If Haleko Road is widened, signalize this intersection when warranted. The intersection is forecast to operate at level of service C in both peak periods if signalized. The left westbound lane of Rice Street is currently marked for through and left turn traffic. It would serve as a default left turn lane and could be restriped as such. This widening and signalization also implies permitting left turns onto Rice Street. A detailed traffic study would need to be done when this widening project is designed.

Under this recommendation, traffic signals would be installed at the Kele Street and Haleko Road intersections to mitigate their individual traffic problems. Implementing both signals would result in four very closely spaced signals with the current signals at Kuhio Highway and Umi Street. This could create a traffic operations problem. Therefore, only one of these two recommended signals should be implemented if possible.

Recommendation 2: If Haleko Road is not widened, the intersection should be left unsignalized and made right turn in, right turn out to minimize the traffic volumes on Haleko Road. Eastbound traffic would be diverted to Kaumualii Highway. The left turn from Rice Street onto Kaumualii Highway would have to be made into two lanes to accommodate the additional traffic. This widening would correspond with the widening

of Kaumualii Highway to four lanes. The resultant levels of service with this recommendation were not analyzed but will be in the traffic study for the Lihue Town Core Urban Design Plan.

Rice Street/Kuhio Highway/Kaumualii Highway

This signalized intersection was recently improved and should be able to accommodate the future traffic growth for the ambient scenarios and recommended plan conditions if Haleko Road is widened. The level of service forecast for the Kuhio Highway southbound left turn lane is forecast to be at E in the morning peak and D in the afternoon peak. Although level of service E is considered to be undesirable, it is considered tolerable for minor movements like left turns if it helps maintain the main through movements at acceptable levels of service. If Haleko Road is not widened, then a second left turn lane from Rice Street should be added as discussed above.

Recommendation: Adjust traffic signal timing as growth occurs. Add a second left turn lane to the Rice Street approach in conjunction with the widening of Kaumualii Highway if Haleko Road is not widened.

Hardy Street

Hardy Street is a two-lane roadway with wide lanes to permit on-street parking. There is a sidewalk on the north curb and painted shoulders or an asphalt berm on the south curb. The roadway curb-to-curb width varies from 40' to 50' and can be poorly defined on the south curb. Hardy Street provides limited access to private driveways on the north curb and to the Lihue Civic Center and State Building parking lots on the south curb.

Hardy Street should be able to operate as a two-lane roadway with the projected traffic growth, although it could operate at level of service D or worse during some time

periods. Further growth would require mitigation as is being proposed in the Lihue Town Core Urban Design Plan.

Recommendation: Signalize the proposed Hardy Street/Akahi Street/County driveway intersection when warranted. Traffic signals are minimally warranted with the forecast traffic volumes. The current two-lane roadway design of Hardy Street would be sufficient, although adding left turn lanes on the Hardy Street approaches would improve traffic operations slightly.

Kuhio Highway/Hardy Street

The left turn movement from Hardy Street westbound onto Kuhio Highway southbound is difficult to make due to the heavy traffic on the highway, and is currently operating at level of service F in both peak periods at this unsignalized intersection. Based on the pattern of traffic volumes, it is believed many drivers are using Eiwa Street as a shortcut to make a right turn onto Rice Street, and make a left turn onto Kamuali'i Highway at the traffic signal. The proposed closure of Eiwa Street would significantly increase the volume of left turns at Hardy Street. Even without the closure of Eiwa Street, traffic signals are warranted at this intersection to meet the latent demand and this is why it was included in Ambient Scenario 2.

The left turn movement from Kuhio Highway southbound onto Hardy Street is at level of service C in the morning peak and B in the afternoon peak. As previously discussed, level of service C condition for the left turn from a through street could identify a need for mitigation.

Recommendation: Signalize the intersection with a leading phase for the Kuhio Highway southbound left turn movement. The intersection is forecast to operate at level of service B in the morning peak and C in the afternoon peak with traffic signalization.

Hardy Street/County-Big Save Driveway

This is one of only two driveways on the south curb of Hardy Street between Kuhio Highway and Umi Street. It is midway between Kuhio Highway and Akahi Street and permits both inbound and outbound left and right turns. This driveway is used by County employees and Big Save market customers since there are large traffic peaks immediately before 7:45 A.M. and after 4:30 P.M. The driveway approach currently operates at level of service C in both peak periods and is forecast to operate at the same level for both ambient scenarios.

The master plan would limit access to right turn in only because the shuttle bus stop would be located immediately east of the driveway. With this restriction, there would be no movements to calculate levels of service, and is shown as a blank space on **Table IV-1**. Two separate analyses indicated that outbound right turns, and outbound and inbound left turns would operate at satisfactory levels of service if permitted, although the outbound left/right movement would be at level of service E in the P.M. peak.

Recommendation: All inbound and outbound movements should be permitted at this driveway under the master plan if feasible to reduce demand at the proposed Akahi Street/County driveway intersection. The feasibility of any outbound movement would depend on the frequency of bus service and whether or not buses would be parking at the bus stop for long periods of time. If the bus stop is expected to be unoccupied for most of the time, then right turn in, right turn out operations should be permitted when the master plan is implemented. Then traffic conditions should be monitored to determine if the outbound movements are interfering with the shuttle bus operations.

The feasibility of permitting inbound and outbound left turns into and from the driveway would depend on whether or not traffic queues from the Kuhio Highway/Hardy Street intersection backed up to this driveway. If the traffic queue does not back up to the driveway, then inbound and outbound left turns should be permitted and monitored.

The driveway could be located further west to get it away from bus stop, however this would bring the driveway closer to Kuhio Avenue, and could obviate implementing left turns at this driveway.

Hardy Street/Akahi Street/Proposed County Driveway

Akahi Street and Eiwa Street intersect Hardy Street from opposite sides about 50' apart. The master plan proposes the closure of Eiwa Street and a new roadway to the County parking lot directly across from Akahi Street. This would eliminate the "zig-zag" movement now required to cross Hardy Street. This intersection is currently unsignalized.

Outbound traffic from the unsignalized Akahi Street approach is currently operating at level of service B in both peak hours due to the relatively low traffic volumes on Hardy Street. The higher through traffic volumes forecast for the ambient scenarios would cause the approach to operate at levels D and F in the A.M. peak and F in the P.M. peak. This would imply the need for some form of mitigation.

The higher traffic volumes forecast for Hardy Street due to general traffic growth are expected to have an adverse impact on the outbound traffic from both side streets. Both the Akahi Street and the County parking lot roadway approaches are forecast to operate at level of service F in both peak periods with the current two-lane design. Several alternatives were analyzed to mitigate this problem. Adding a left turn lane on both approaches of Hardy Street would still incur level of service F. Changing the two-lane and left turn lane designs into a four way stop would also not improve the level of service F. The high volumes of eastbound traffic forecast for Hardy Street are responsible for causing the poor levels of service. For these possible mitigating alternatives, A.M. traffic conditions were analyzed with a 12% traffic increase that was developed as an earlier forecast. The higher 20% growth rate used for this study was not evaluated since the levels of service with the lower growth rate were already very undesirable.

Recommendation: Signalize the proposed intersection when warranted. Traffic signals are minimally warranted with the forecast traffic volumes. The current two-lane roadway design of Hardy Street would be sufficient, although adding left turn lanes on the Hardy Street approaches would allow through traffic to safely pass cars queuing to turn left.

Hardy Street/Eiwa Street

The northbound approach of Eiwa Street is currently operating at level of service B in both peak periods. As with Akahi Street, the higher through traffic volumes forecast for Hardy Street would cause the Eiwa Street approach to operate at level of service F for both ambient scenarios in both peak periods. This intersection would be eliminated with the recommended plan's proposed closure of Eiwa Street.

Hardy Street/Umi Street

The northbound approach of Umi Street is currently operating at level of service F in the A.M. peak and E in the P.M. peak. The master plan proposes a traffic roundabout as one means to mitigate the problem. Traffic roundabouts were thought to be a better solution than traffic signals due to the unique geometry of this intersection. Traffic signals would probably require split phasing that would reduce the green time for Hardy Street traffic. There is sufficient land to install a traffic roundabout. Additionally, a traffic roundabout would be more inexpensive to install and easier to maintain than a traffic signal. A four-way stop would not be feasible due to the much higher traffic volumes on the east approach.

The analysis for traffic roundabouts does not calculate a level of service value due to the limited American experience with roundabouts. The HCS methodology for traffic roundabouts calculates only a volume/capacity (v/c) ratio. The eastbound approach of

Hardy Street is forecast to have the highest v/c ratio of the four approaches, ranging from 0.61 in the morning peak to 0.70 in the afternoon.

Umi Street/State-County Driveway

Umi Street is a two-lane roadway with on-street parking on the eastern boundary of the Lihue Civic Center. The current one-way ingress and egress driveways to the State and County parking lots are set apart about 60'. The master plan proposes a single two-lane access roadway.

Recommendation: Large traffic increases are not forecast for Umi Street; therefore, major traffic improvements are not required. The current two-lane roadway design without left turn lanes would be sufficient. The analysis assumed separate left and right turn lanes on the driveway approach. A left turn lane on the northbound Umi Street approach would be desirable but not necessary.

The driveway to the 26-stall State Courthouse parking lot was not analyzed due to its small size. Based on the above analysis, traffic problems are not expected.

This recommendation assumes no major land use changes for the State properties on Umi Street, including the vacant Police Building. Major land use changes would require a restudy of the Umi Street design.

V. SUMMARY OF TRAFFIC RECOMMENDATIONS TO SUPPORT THE RECOMMENDED MASTER PLAN

This section lists the recommendations made in the previous section.

1. The four-lane design of Rice Street would be sufficient in the future but permitting on-street parking during the day time off-peak periods would need to be studied closer. Further roadway improvements are being proposed under the Lihue Town Core Urban Design Plan.

2. Convert the left eastbound lane of Rice Street at Umi Street into an exclusive left turn lane by restriping. Create a three phase signal with a leading left turn and through phase for eastbound traffic. This may require new traffic signals to provide the mastarms required for leading turn phases.

3. The Rice Street/Eiwa Street unsignalized intersection would be eliminated under the master plan. If the master plan were not implemented and Eiwa Street were maintained, the only way to mitigate traffic problems at both ends of Eiwa Street for the ambient scenarios would be to signalize the intersections, which then would then cause a major change in the traffic patterns.

4. The master plan proposes to relocate the County/Kauai Museum driveway westward to align directly across Kele Street. With this move, restrict the traffic movements to right-turn in, right-turn out at these two approaches. As an alternative if right turn only restrictions are not acceptable, signalize the intersection. Traffic signals are barely warranted with the forecast volumes but pedestrian crossings would become safer with traffic signals.

5. If Haleko Road is widened, signalize the Rice Street intersection when warranted. Restripe the left westbound lane of Rice Street with a left turn lane. This widening and signalization also implies permitting left turns onto Rice Street. A detailed traffic study would need to be done when this widening project is designed. Under this recommendation, traffic signals would be installed at the Kele Street and Haleko Road intersections to mitigate their individual traffic problems. Implementing both signals would result in four very closely spaced signals on Rice Street with the current signals at Kuhio Highway and Umi Street. This could create a traffic operations problem. Therefore, only one of these two recommended signals should be implemented if possible.

If Haleko Road is not widened, the Rice Street intersection should be left unsignalized and made right turn in, right turn out to minimize the traffic volumes on Haleko Road. Eastbound traffic would be diverted to Kaumualii Highway. The left turn from Rice Street onto Kaumualii Highway would have to be made into two lanes to accommodate the additional traffic. This widening would correspond with the widening of Kaumualii Highway to four lanes.

6. Adjust traffic signal timing at the Rice Street/Kuhio Highway/Kaumualii Highway intersection as growth occurs. Add a second left turn lane to the Rice Street approach if Haleko Road is not widened, and coordinate with the widening of Kaumualii Highway west of Rice Street. This would require coordination with the State Department of Transportation who has jurisdiction over the highways.

7. Signalize the Kuhio Highway/Hardy Street intersection with a leading phase for the Kuhio Highway southbound left turn movement. This would require coordination with the State Department of Transportation who has jurisdiction over the highway.

8. Signalize the proposed Hardy Street/Akahi Street/County driveway intersection when warranted. Traffic signals are minimally warranted with the forecast traffic volumes. The current two-lane roadway design of Hardy Street would be sufficient, although adding left turn lanes on the Hardy Street approaches would improve traffic operations slightly. Further traffic growth would require mitigation as is being proposed in the Lihue Town Core Urban Design Plan.

9. The master plan proposes a traffic roundabout at the Hardy Street/Umi Street intersection as one means to mitigate the current problems. This would provide acceptable service levels and avoid delays that may be incurred if a traffic signal were installed.

10. Large traffic increases are not forecast for Umi Street; therefore, major traffic improvements are not required. The current two-lane roadway design without left turn lanes would be sufficient. A left turn lane on the northbound Umi Street approach to the new driveway would be desirable but not necessary. This recommendation assumes no major land use changes for the State properties on Umi Street, including the vacant Police Building. Major land use changes would require a restudy of the Umi Street design.

References

References

1. *Kauai County Office Complex Traffic Impact Analysis Report*, November 1989, Pacific Planning and Engineering, Inc.

2. *Highway Capacity Manual*, 2000, HCM2000, Transportation Research Board.

3. *Kauai Long Range Land Transportation Plan*, 1997, Austin Tsutsumi and Associates, Inc.

4. *Statewide Transportation Improvement Program: FY 2004 Thru FY2006, Amendment #8*, 2002, revised 2005, Kaku Associates, Inc.

Figures

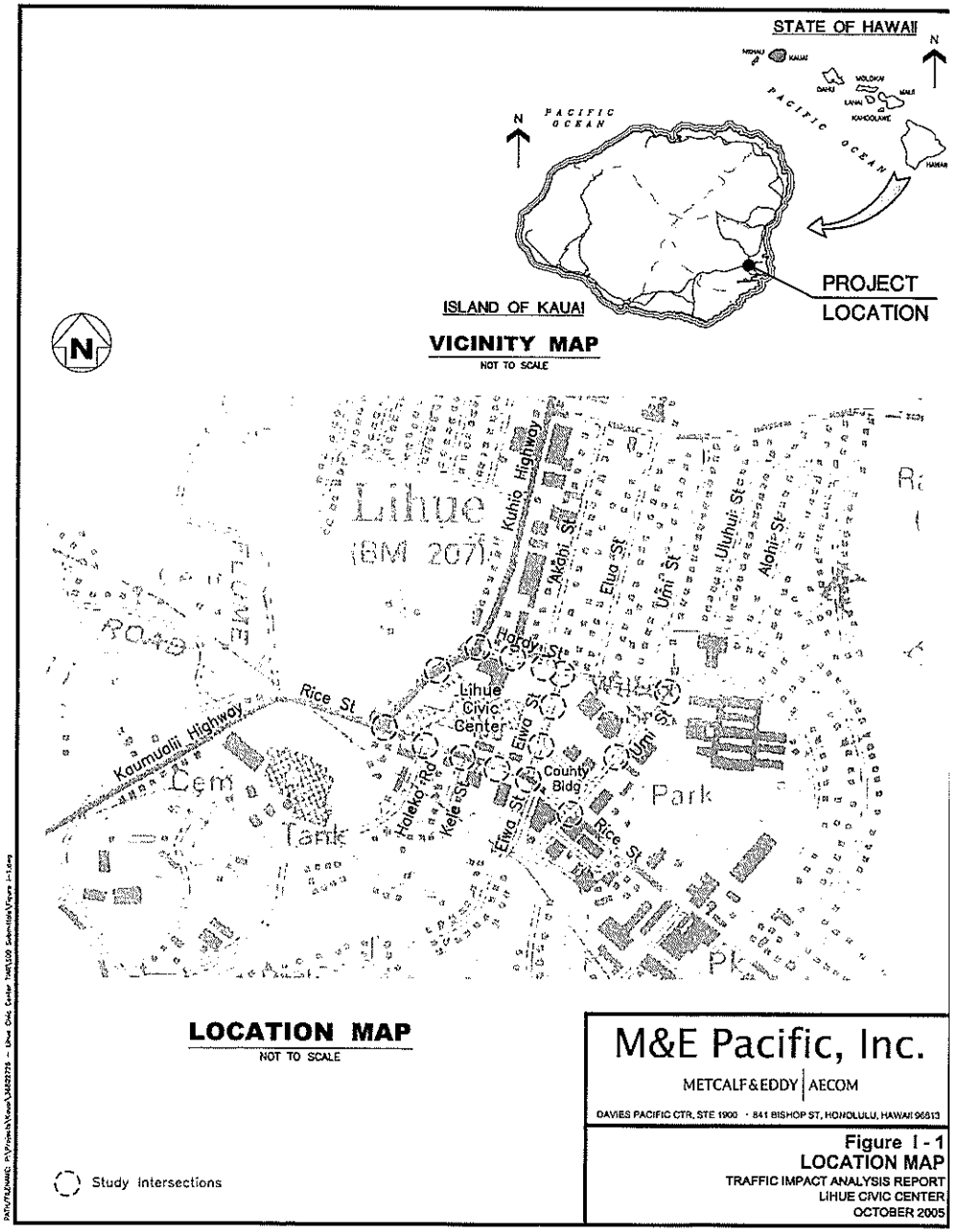
STATE OF HAWAII
PACIFIC OCEAN
ISLAND OF KAUAI
PROJECT LOCATION
VICINITY MAP
NOT TO SCALE
Lihue
(BM 207)
Kuhio Highway
Akahi St
Ehua St
Hardy St
Rice St
Kaumualii Highway
Lihue Civic Center
County Bldg
Halelea Rd
Keje St
Umi St
Uluhui St
Alohi St
Park
Tank
LOCATION MAP
NOT TO SCALE
Study Intersections
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Figure 1-1
LOCATION MAP
TRAFFIC IMPACT ANALYSIS REPORT
LIHUE CIVIC CENTER
OCTOBER 2005

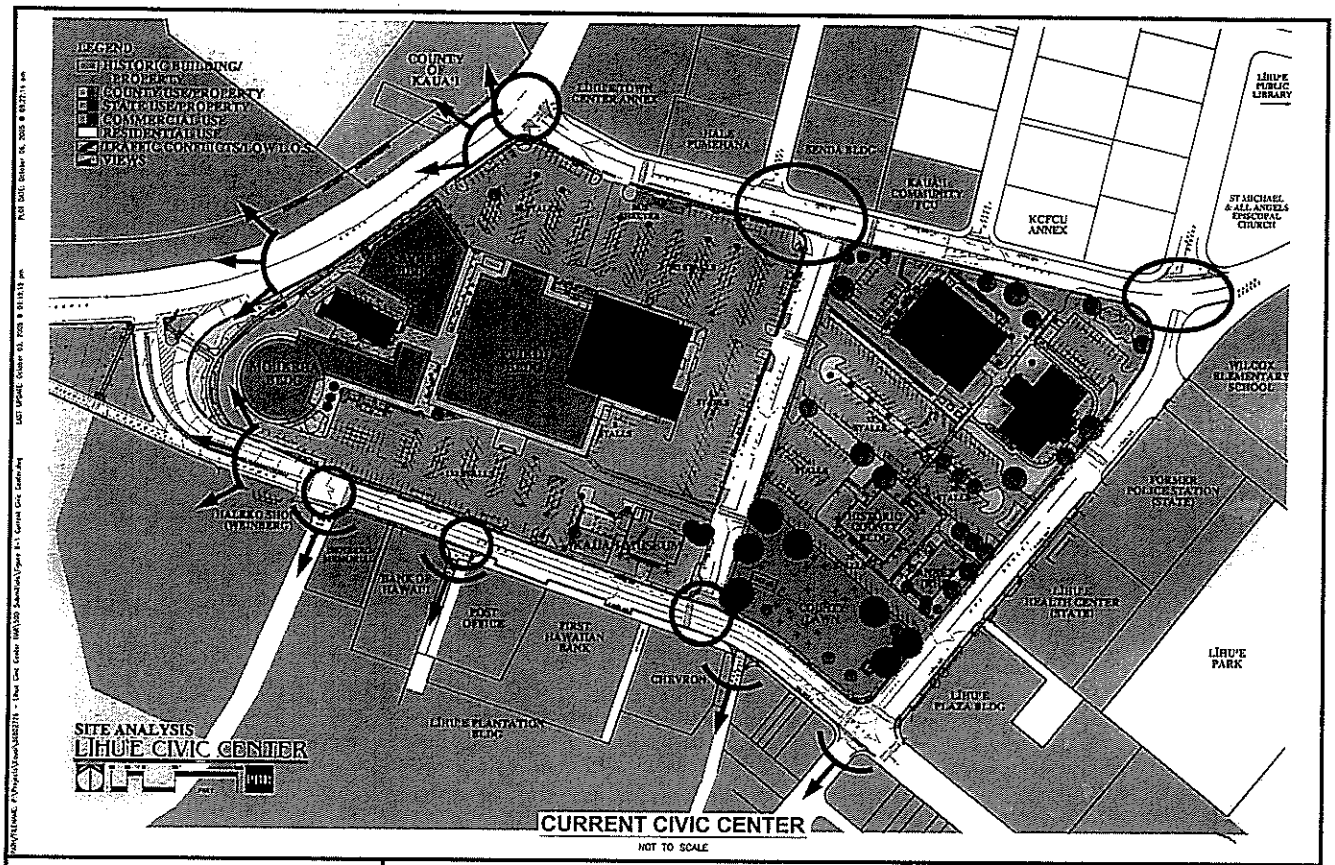

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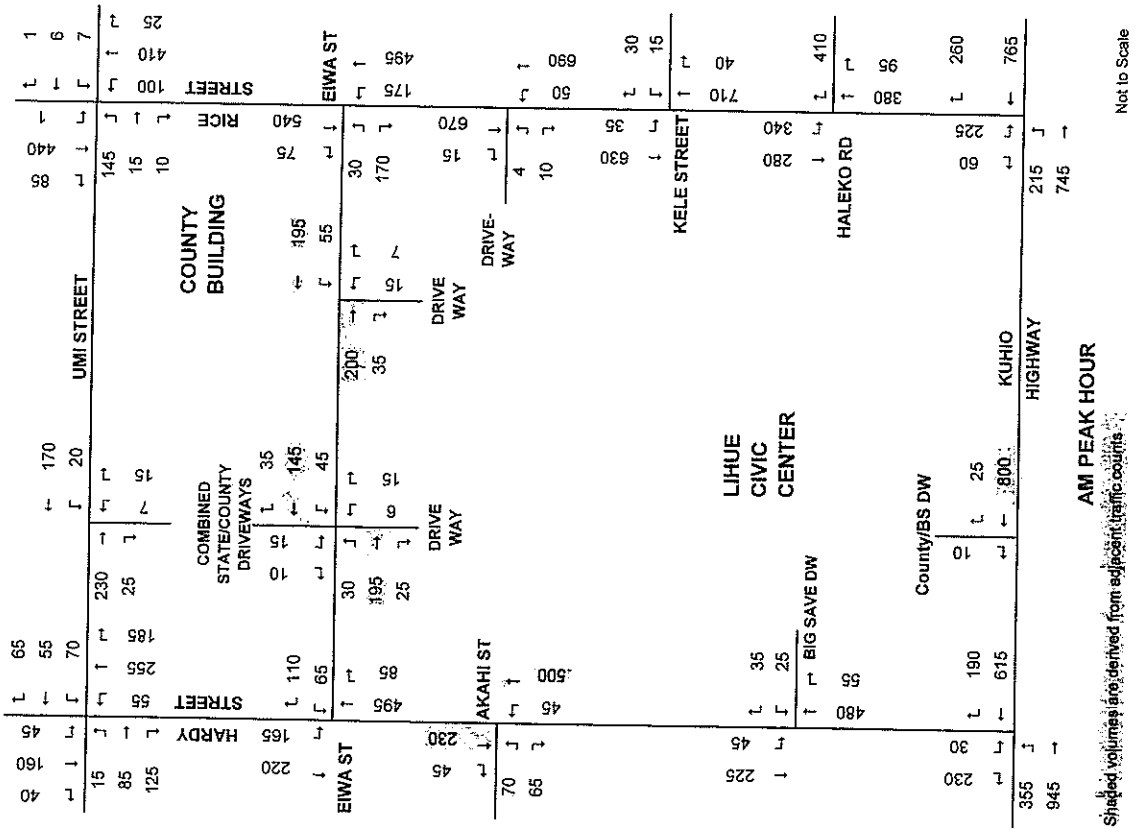
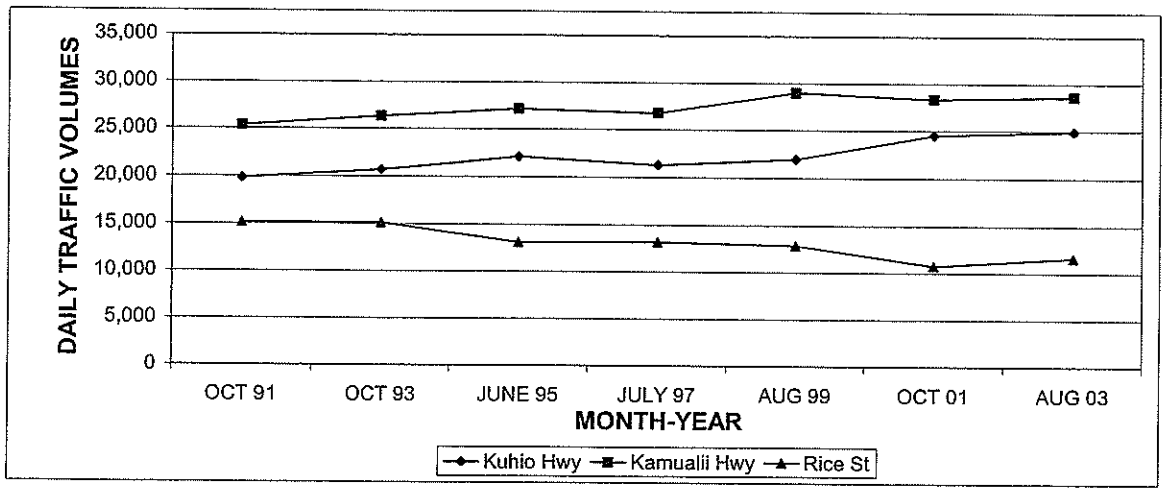
Figure II-1
CURRENT CIVIC CENTER
TRAFFIC IMPACT ANALYSIS REPORT
LIHUE CIVIC CENTER
LIHUE, KAUAI, HAWAII
OCTOBER, 2005



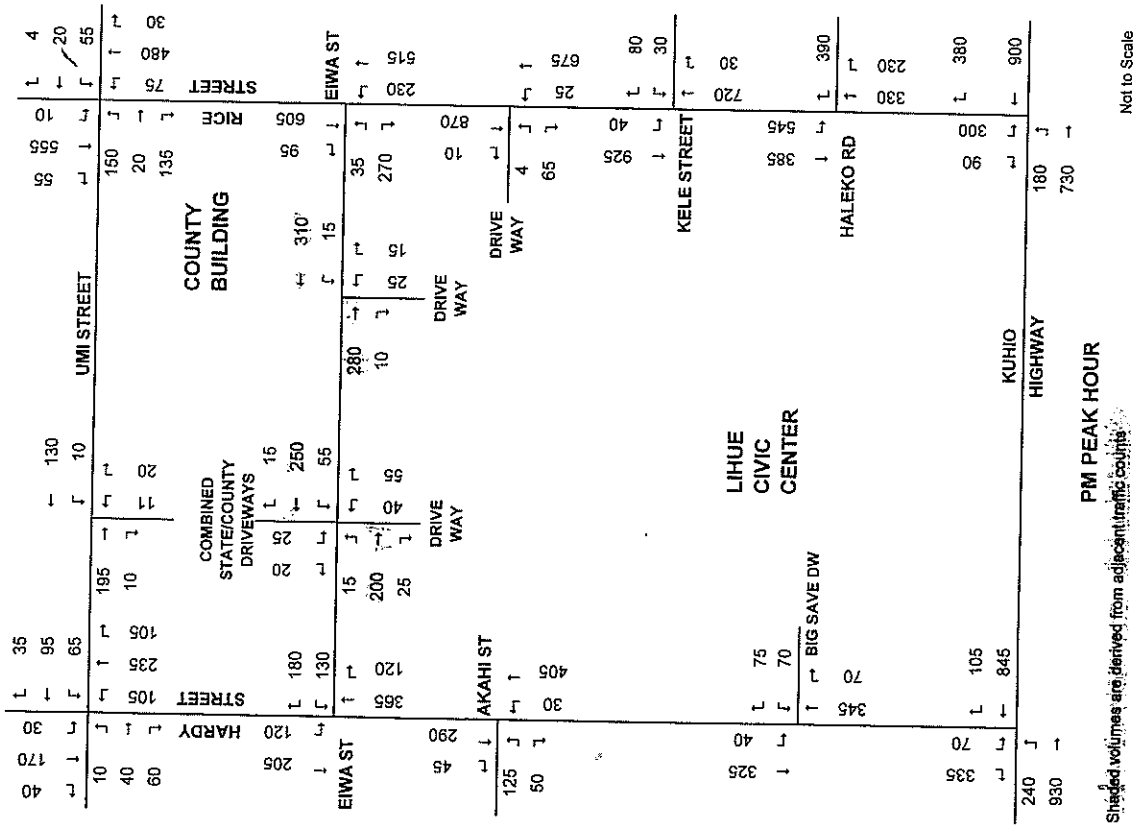
EXISTING TRAFFIC VOLUMES
FIGURE II-2A

DAILY TRAFFIC VOLUMES AT STATION NO. 1-B
Kaumualii Highway/Kuhio Highway/Rice Street

DATE OF COUNT	DAILY TRAFFIC VOLUMES		
	KUHIO HIGHWAY	KAUMUALII HIGHWAY	RICE STREET
OCT 91	19,833	25,333	15,146
OCT 93	20,726	26,321	15,135
JUNE 95	22,084	27,132	13,087
JULY 97	21,324	26,744	13,185
AUG 99	21,956	28,990	12,871
OCT 01	24,512	28,341	10,763
AUG 03	24,919	28,604	11,613



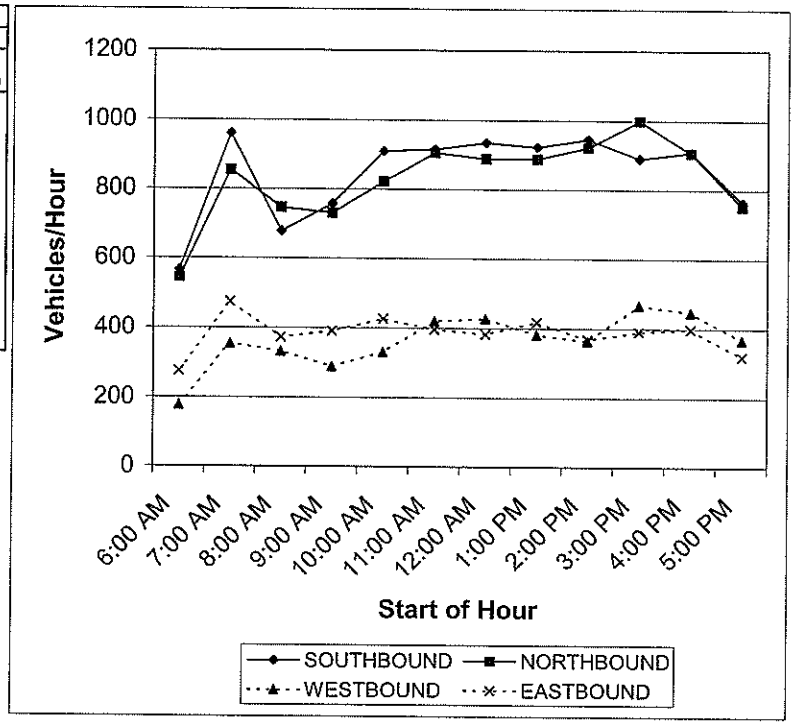
DAILY TRAFFIC VOLUMES ON KUHIO HIGHWAY, KAUMUALII HIGHWAY AND RICE STREET
FIGURE II-3



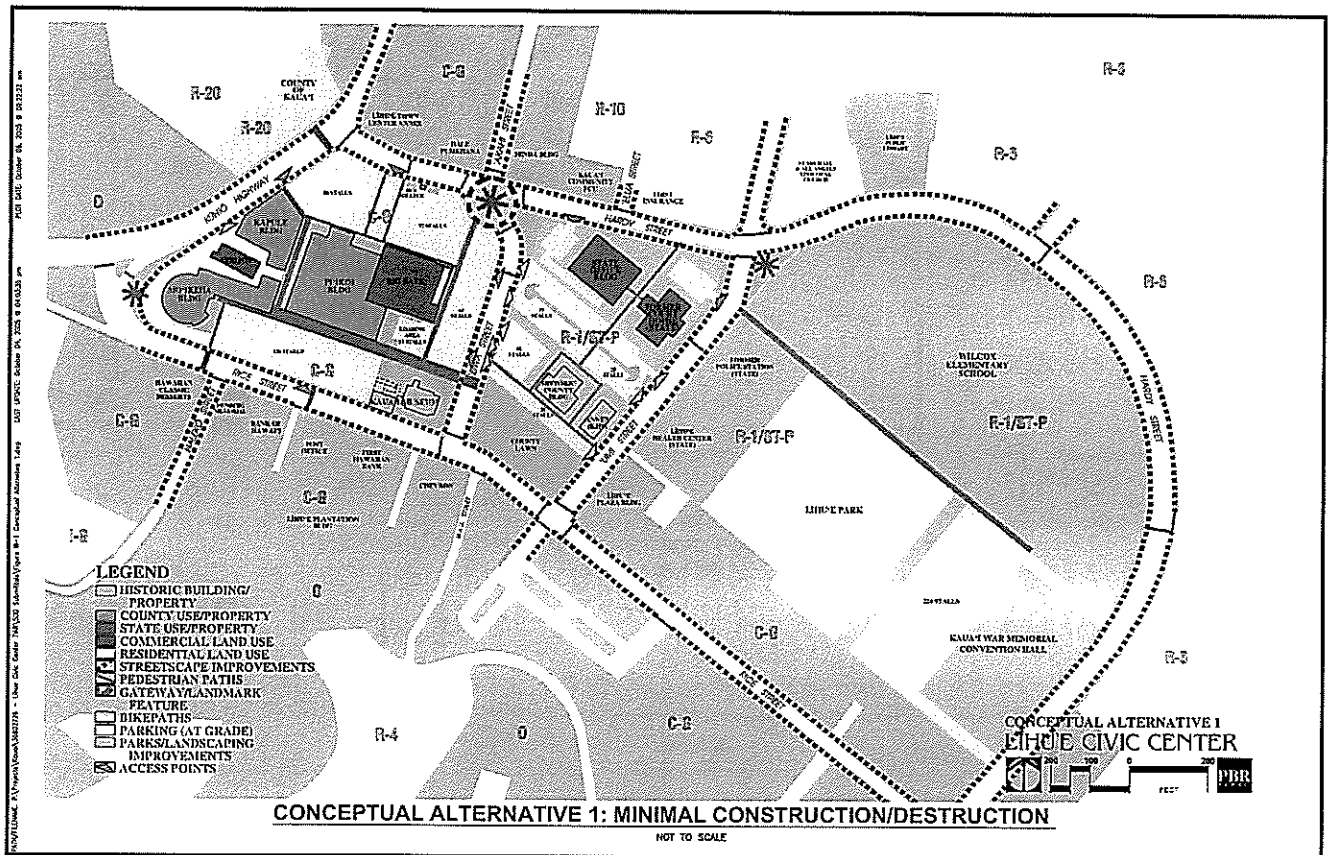
EXISTING TRAFFIC VOLUMES
FIGURE II-2B

HOURLY TRAFFIC VOLUMES AT STATION NO. 1-B, Kuhio Highway/Rice Street (October 11, 2001)

START OF HOUR	VEHICLES/YEAR			
	KUHIO HIGHWAY		RICE STREET	
	SOUTH-BOUND	NORTH-BOUND	WEST-BOUNT	EAST-BOUND
6:00 AM	566	544	178	276
7:00 AM	960	855	355	474
8:00 AM	677	745	332	373
9:00 AM	757	730	289	391
10:00 AM	909	821	331	426
11:00 AM	915	905	420	396
12:00 AM	935	888	428	383
1:00 PM	922	888	382	418
2:00 PM	945	921	364	368
3:00 PM	890	999	467	391
4:00 PM	908	906	447	398
5:00 PM	763	751	368	320



HOURLY TRAFFIC VOLUMES ON KUHIO HIGHWAY AND RICE STREET
FIGURE II-4



CONCEPTUAL ALTERNATIVE 1: MINIMAL CONSTRUCTION/DESTRUCTION

NOT TO SCALE

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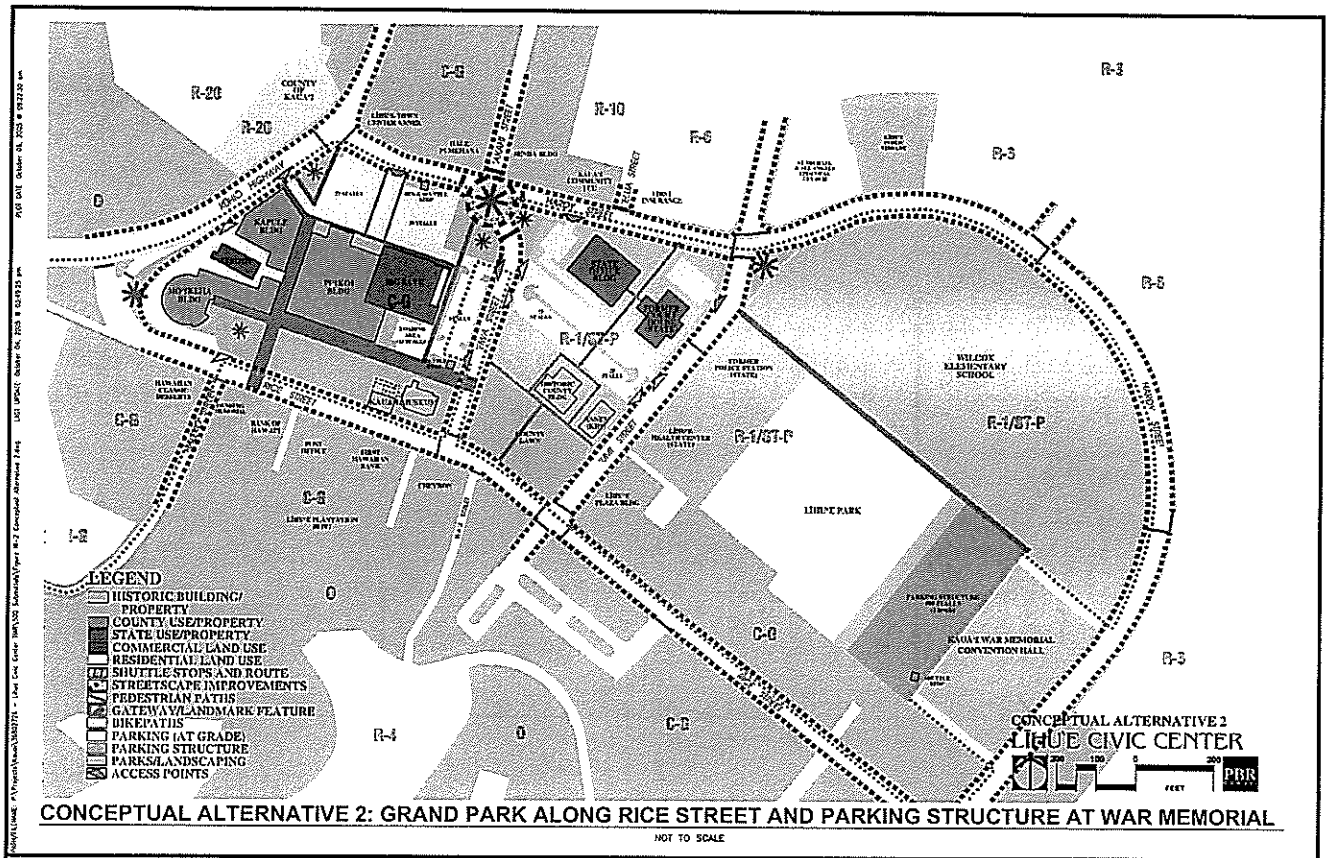
Figure III - 1
CONCEPTUAL ALTERNATIVE 1
TRAFFIC IMPACT ANALYSIS REPORT
LIHUE CIVIC CENTER
LIHUE, KAUAI, HAWAII
OCTOBER, 2005



CONCEPTUAL ALTERNATIVE 2: GRAND PARK ALONG RICE STREET AND PARKING STRUCTURE AT WAR MEMORIAL

NOT TO SCALE

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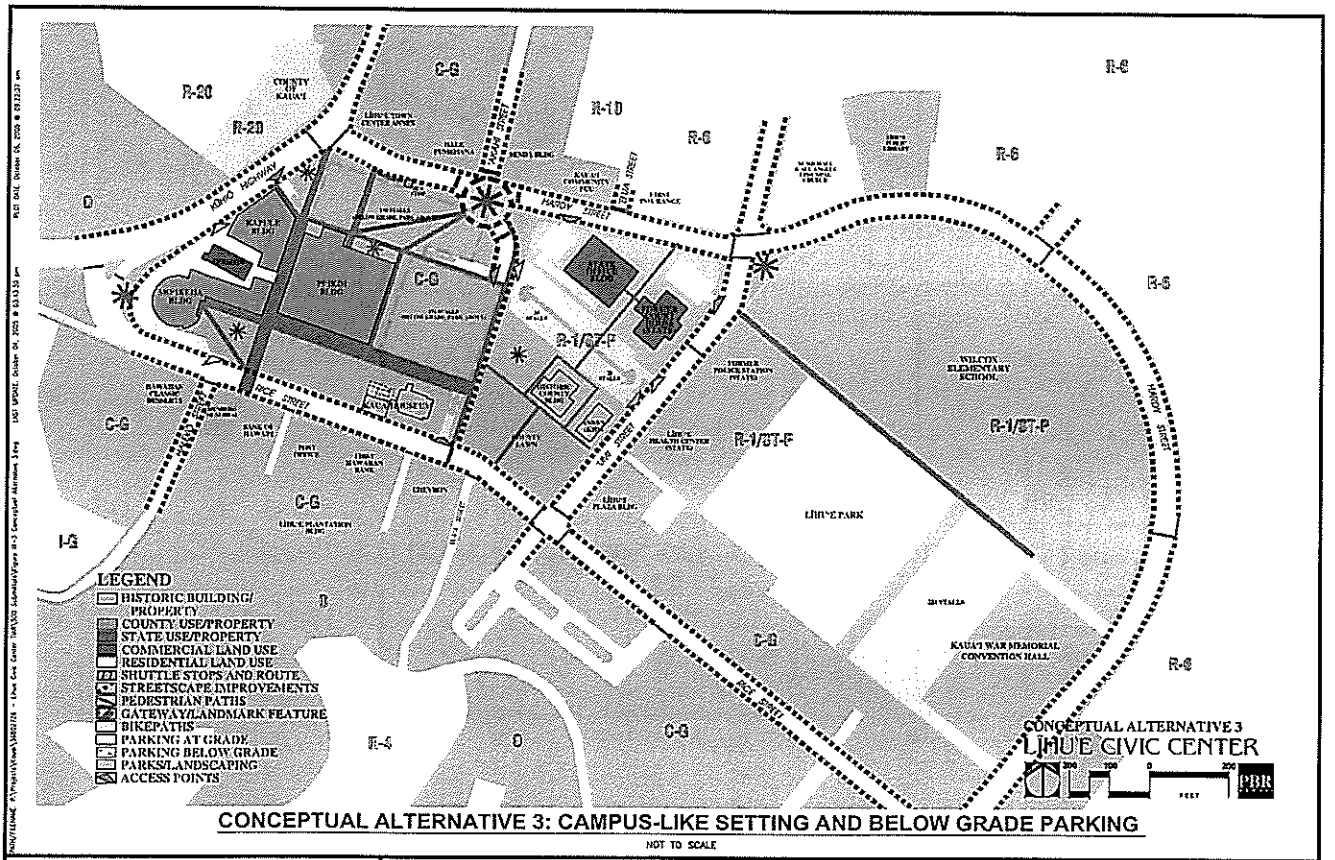
Figure III - 2
CONCEPTUAL ALTERNATIVE 2
TRAFFIC IMPACT ANALYSIS REPORT
LIHUE CIVIC CENTER
LIHUE, KAUAI, HAWAII
OCTOBER, 2005



CONCEPTUAL ALTERNATIVE 3: CAMPUS-LIKE SETTING AND BELOW GRADE PARKING

NOT TO SCALE

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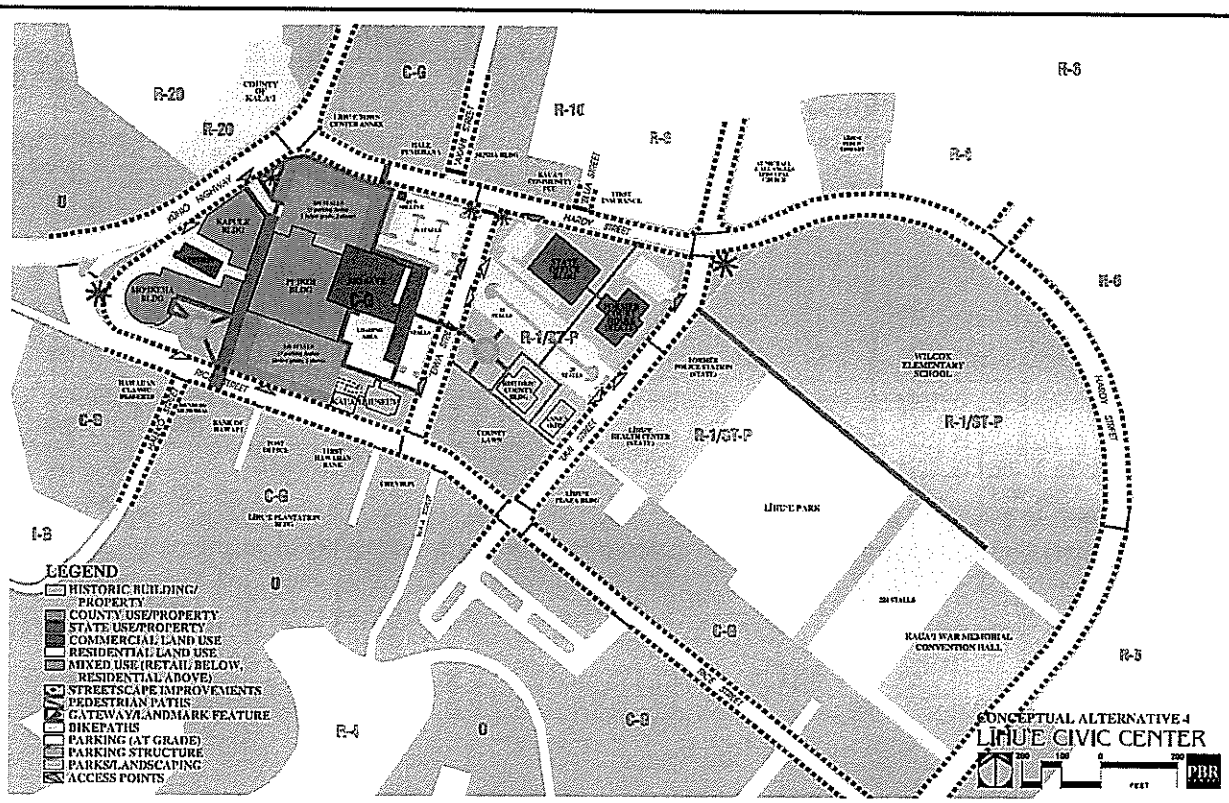
Figure III - 3
CONCEPTUAL ALTERNATIVE 3
TRAFFIC IMPACT ANALYSIS REPORT
LIHUE CIVIC CENTER
LIHUE, KAUAI, HAWAII
OCTOBER, 2005



CONCEPTUAL ALTERNATIVE 4: URBAN MIXED USE CIVIC CENTER AND TWO PARKING GARAGES

NOT TO SCALE

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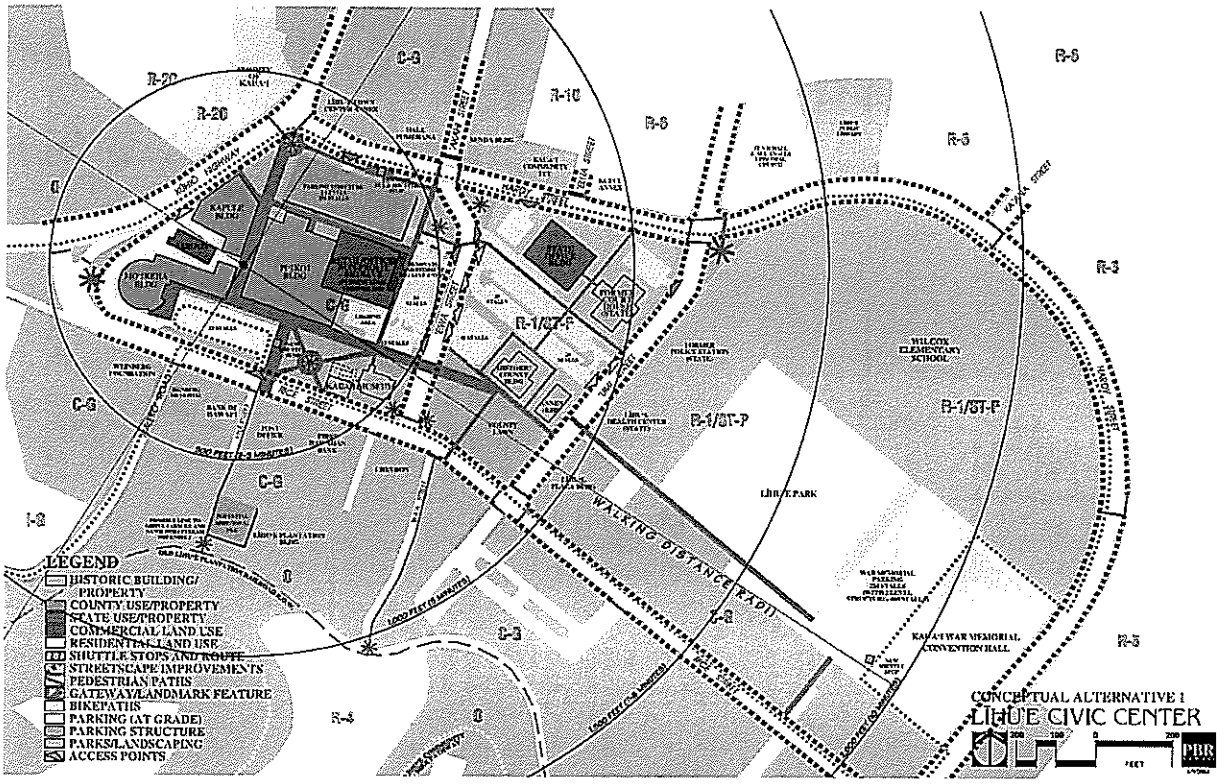
DAVIES PACIFIC CTR, STE 1900 · 841 BISHOP ST, HONOLULU, HAWAII 96813

Figure III - 4
CONCEPTUAL ALTERNATIVE 4
TRAFFIC IMPACT ANALYSIS REPORT
LIHUE CIVIC CENTER
LIHUE, KAUAI, HAWAII
OCTOBER, 2005



REFINED ALTERNATIVE 1

NOT TO SCALE

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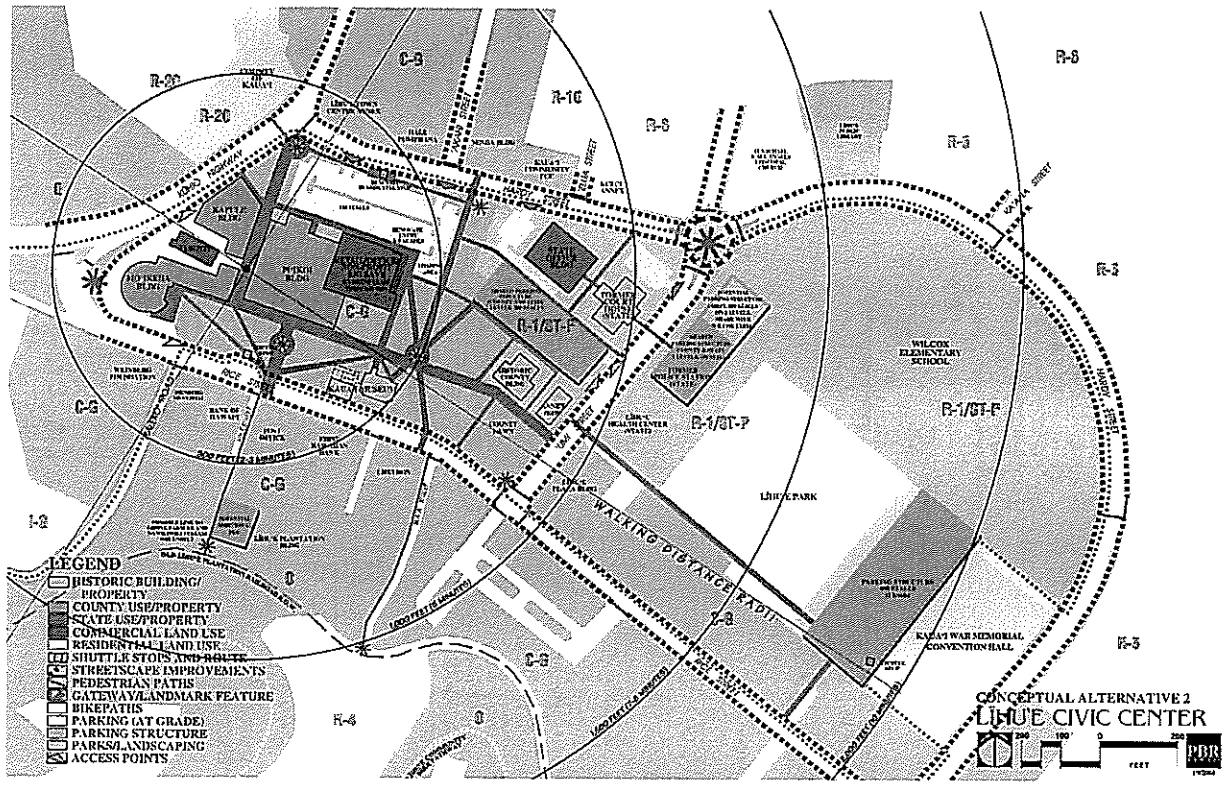
Figure III - 5
REFINED ALTERNATIVE 1
TRAFFIC IMPACT ANALYSIS REPORT
LIHUE CIVIC CENTER
LIHUE, KAUAI, HAWAII
OCTOBER, 2005



REFINED ALTERNATIVE 2

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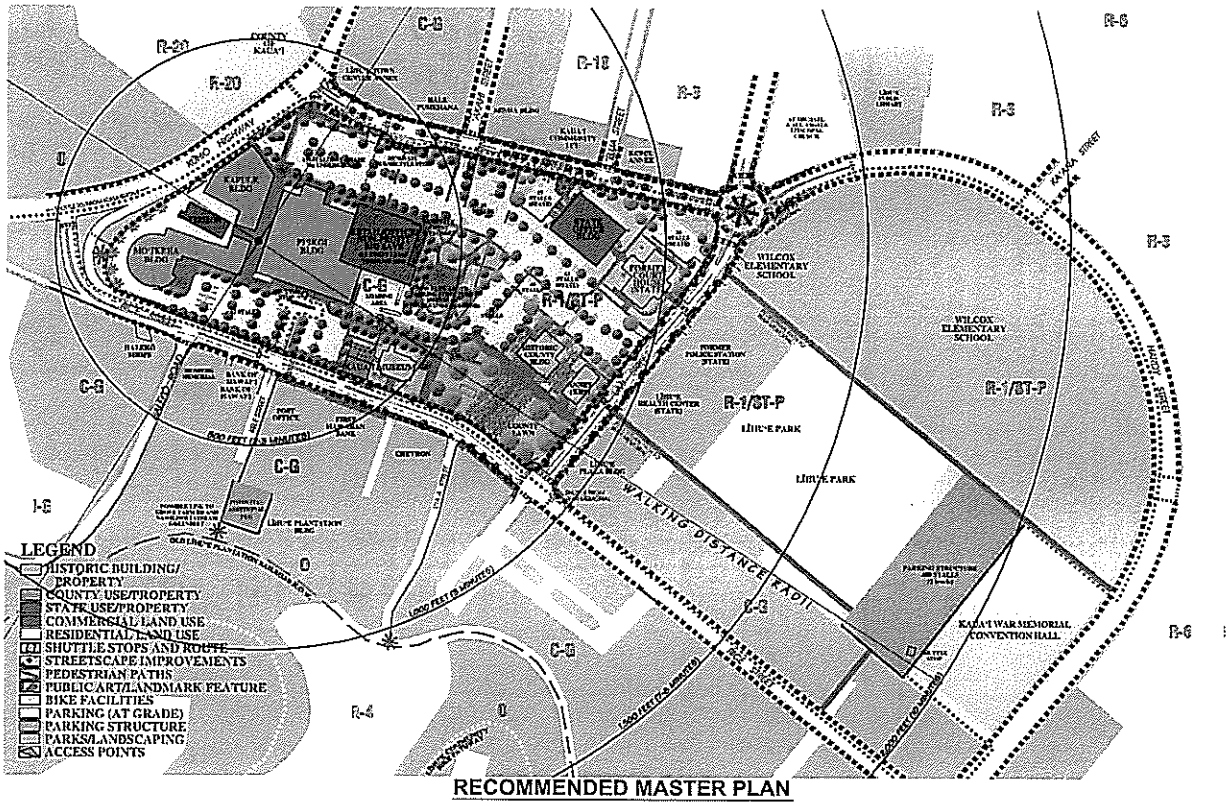
Figure III - 6
REFINED ALTERNATIVE 2
TRAFFIC IMPACT ANALYSIS REPORT
LIHUE CIVIC CENTER
LIHUE, KAUAI, HAWAII

OCTOBER, 2005



RECOMMENDED MASTER PLAN

NOT TO SCALE

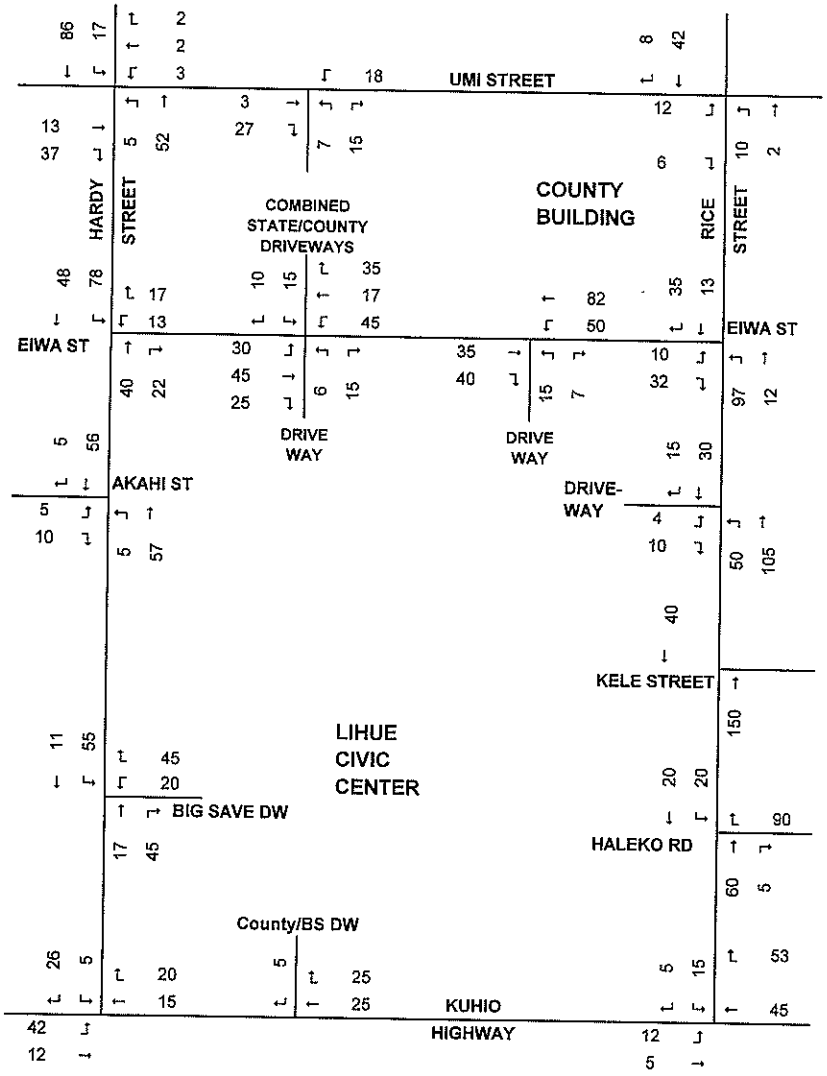
M&E Pacific, Inc.

METCALF & EDDY | AECOM

DAVIES PACIFIC CTR, STE 1900 · 841 BISHOP ST, HONOLULU, HAWAII 96813

Figure IV- 1
RECOMMENDED MASTER PLAN
TRAFFIC IMPACT ANALYSIS REPORT
LIHUE CIVIC CENTER
LIHUE, KAUAI, HAWAII

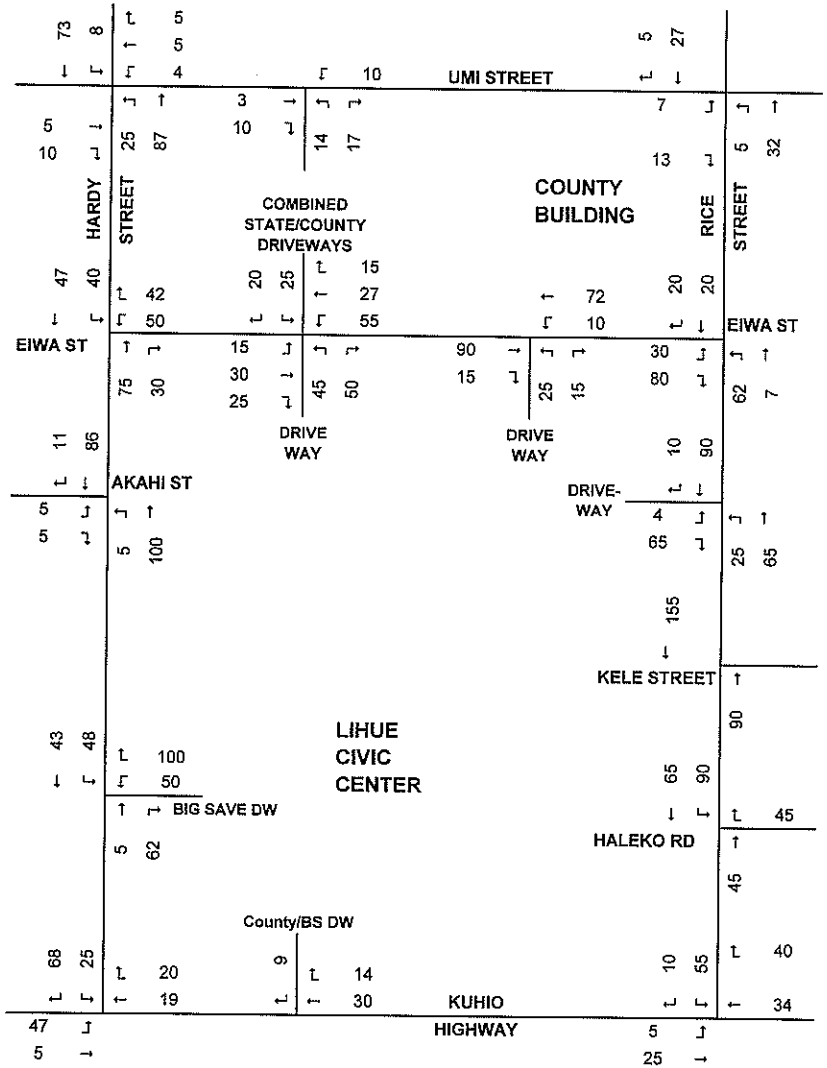
OCTOBER, 2005



AM PEAK HOUR

Not to Scale

EXISTING TURNS INTO CIVIC CENTER PARKING AREAS ADJUSTED FOR OPENING OF KA'ANA STREET EXTENSION
FIGURE IV-2A



PM PEAK HOUR

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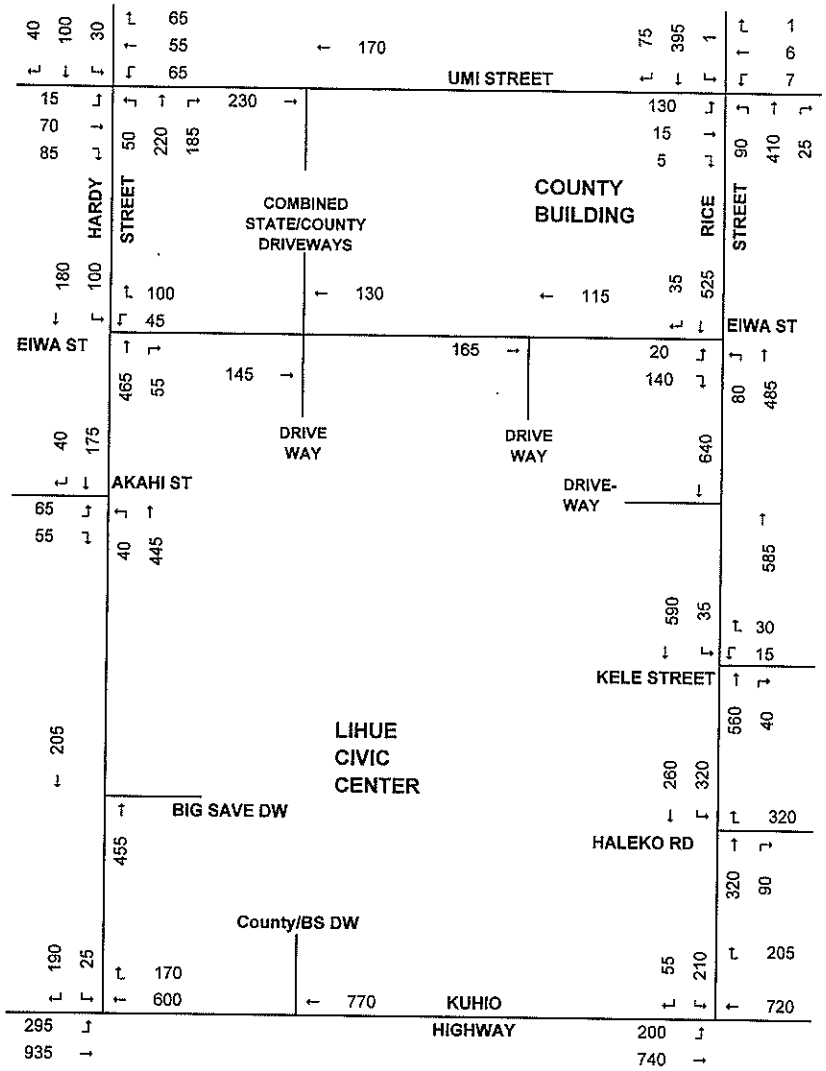
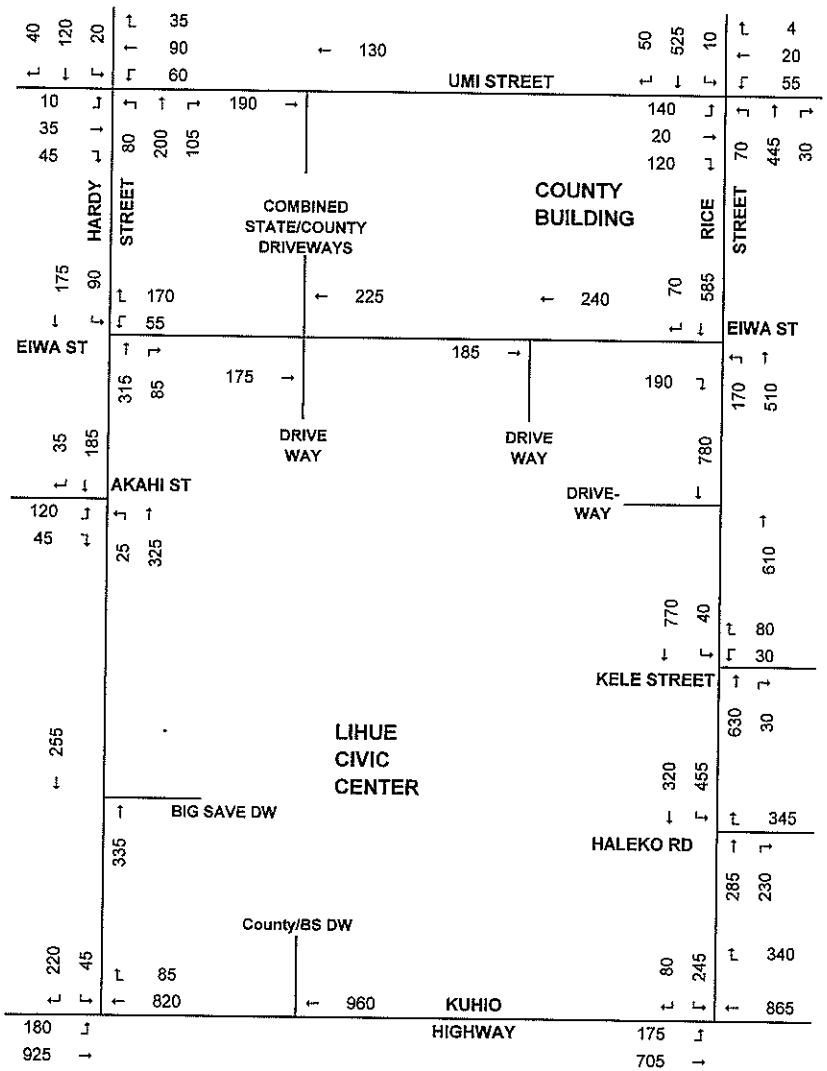
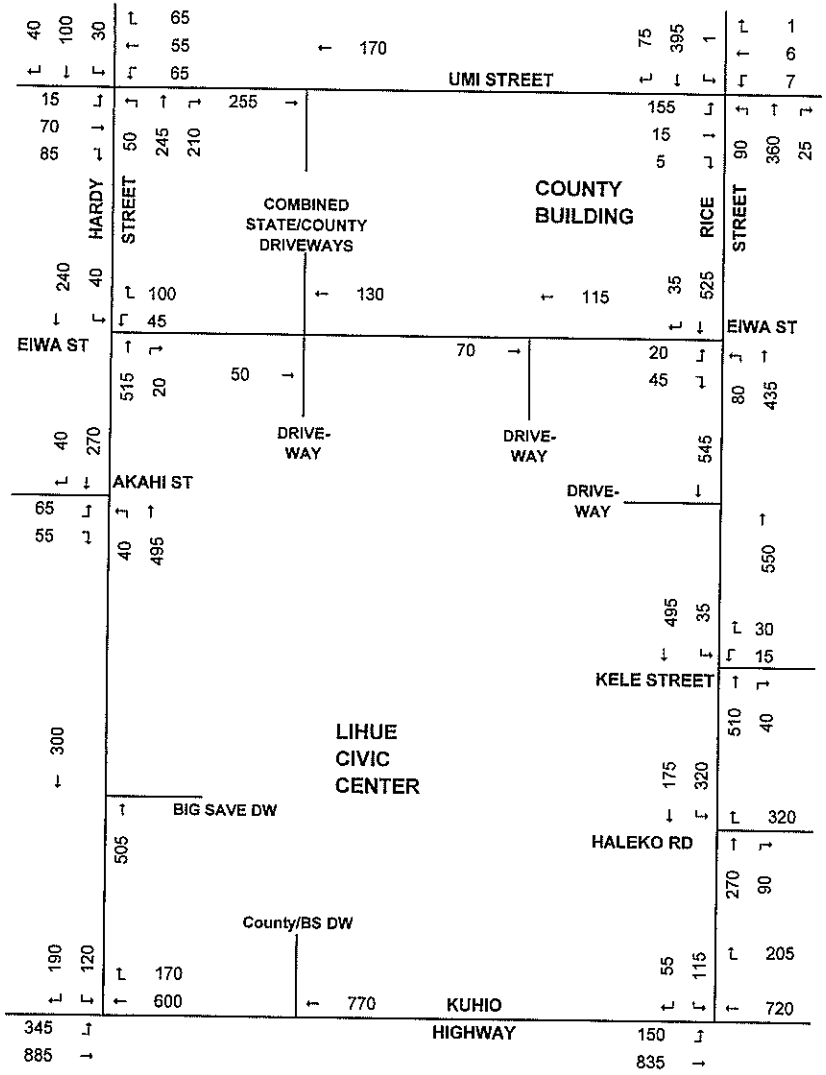
EXISTING TURNS INTO CIVIC CENTER PARKING AREAS ADJUSTED FOR OPENING OF KA'ANA STREET EXTENSION
FIGURE IV-2B



EXISTING THROUGH TRAFFIC VOLUMES
FIGURE IV-3A



EXISTING THROUGH TRAFFIC VOLUMES
FIGURE IV-3B



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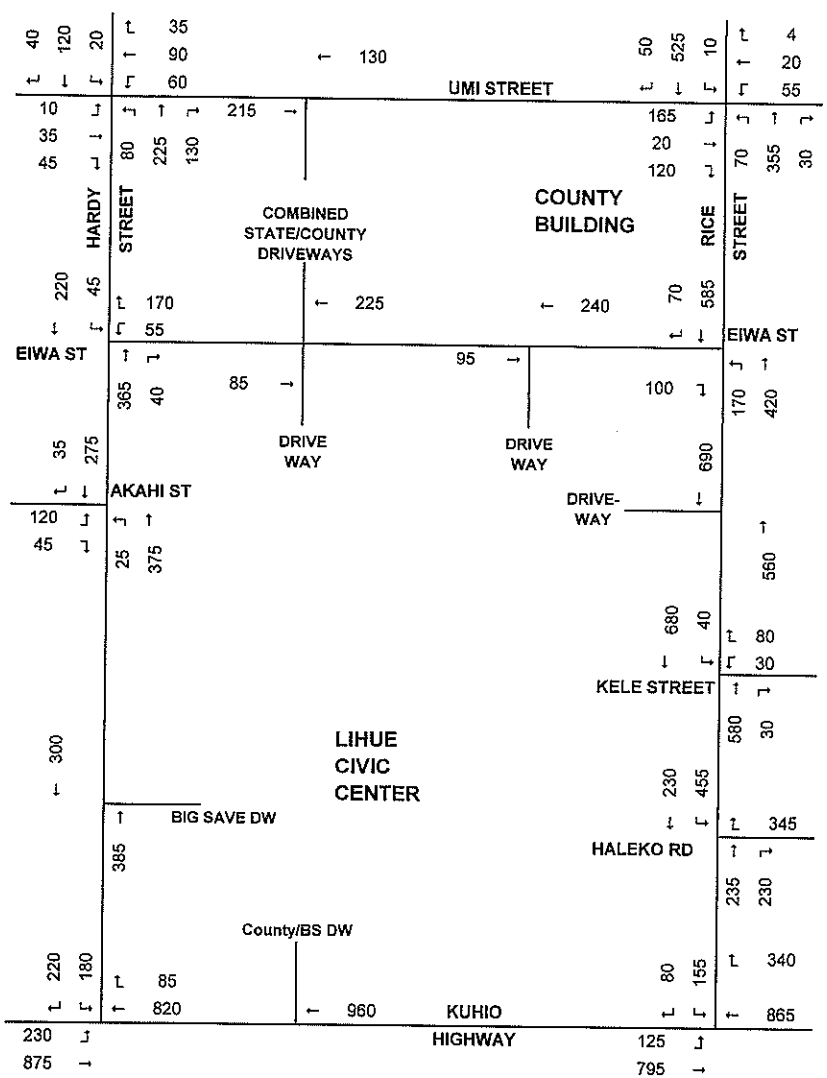
EXISTING THROUGH TRAFFIC VOLUMES
ADJUSTED FOR KUHIO/HARDY SIGNAL (AMBIENT SCENARIO 2)
FIGURE IV-4A



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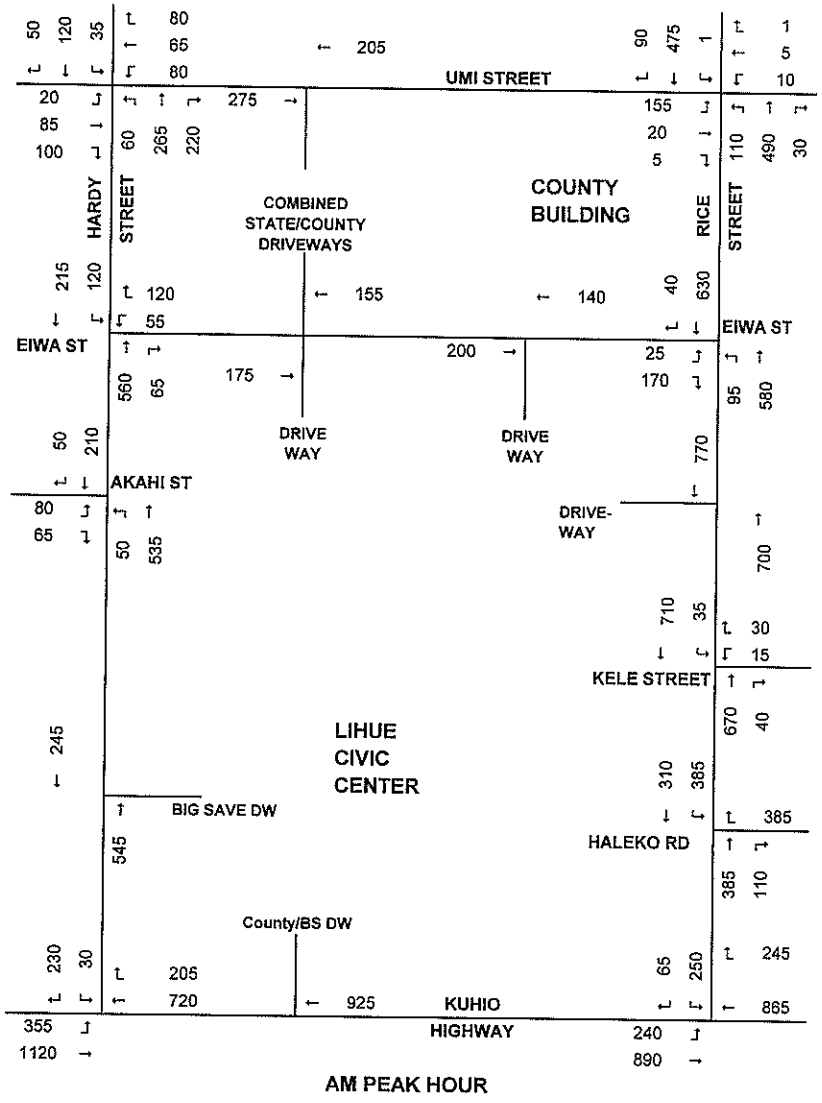
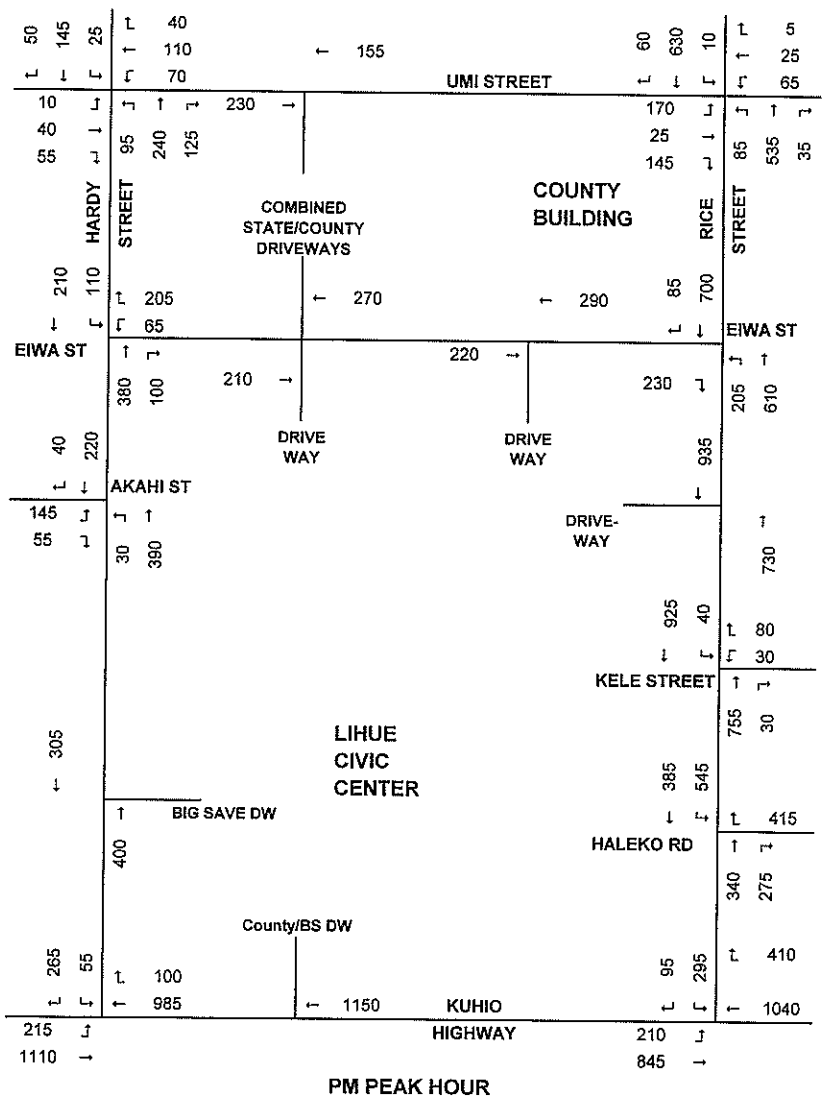
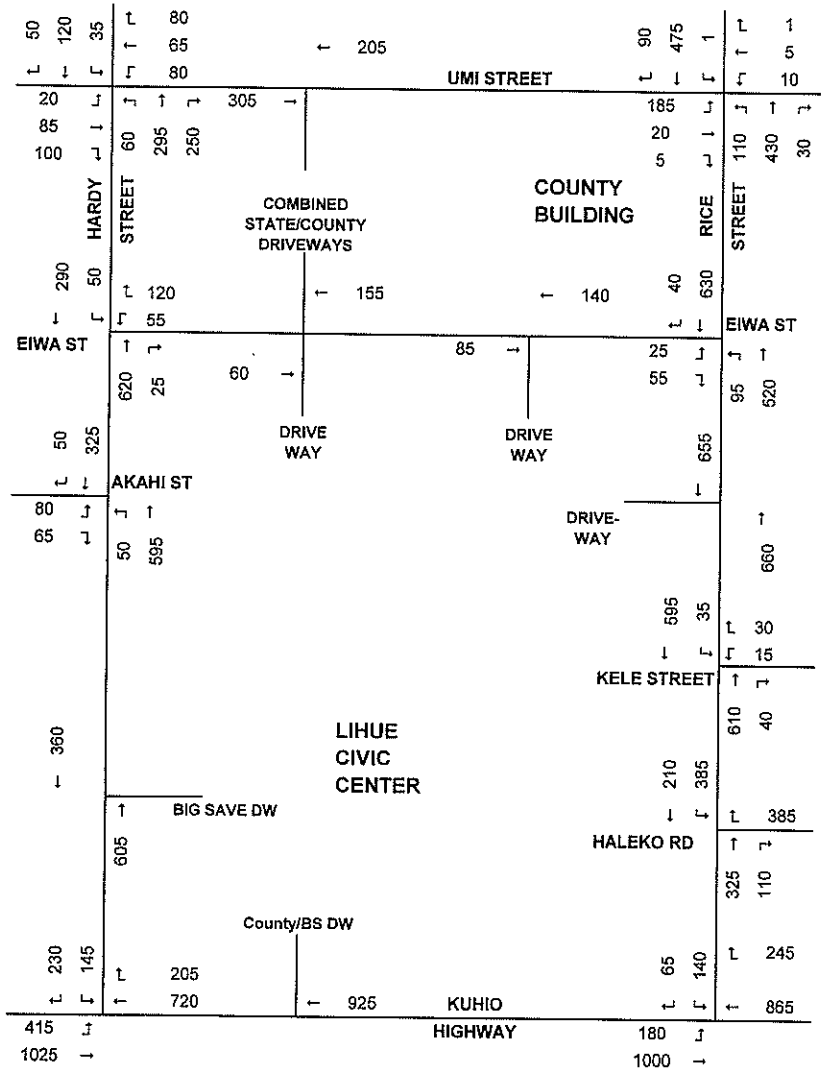
EXISTING THROUGH TRAFFIC VOLUMES
ADJUSTED FOR KUHIO/HARDY SIGNAL (AMBIENT SCENARIO 2)
FIGURE IV-4B



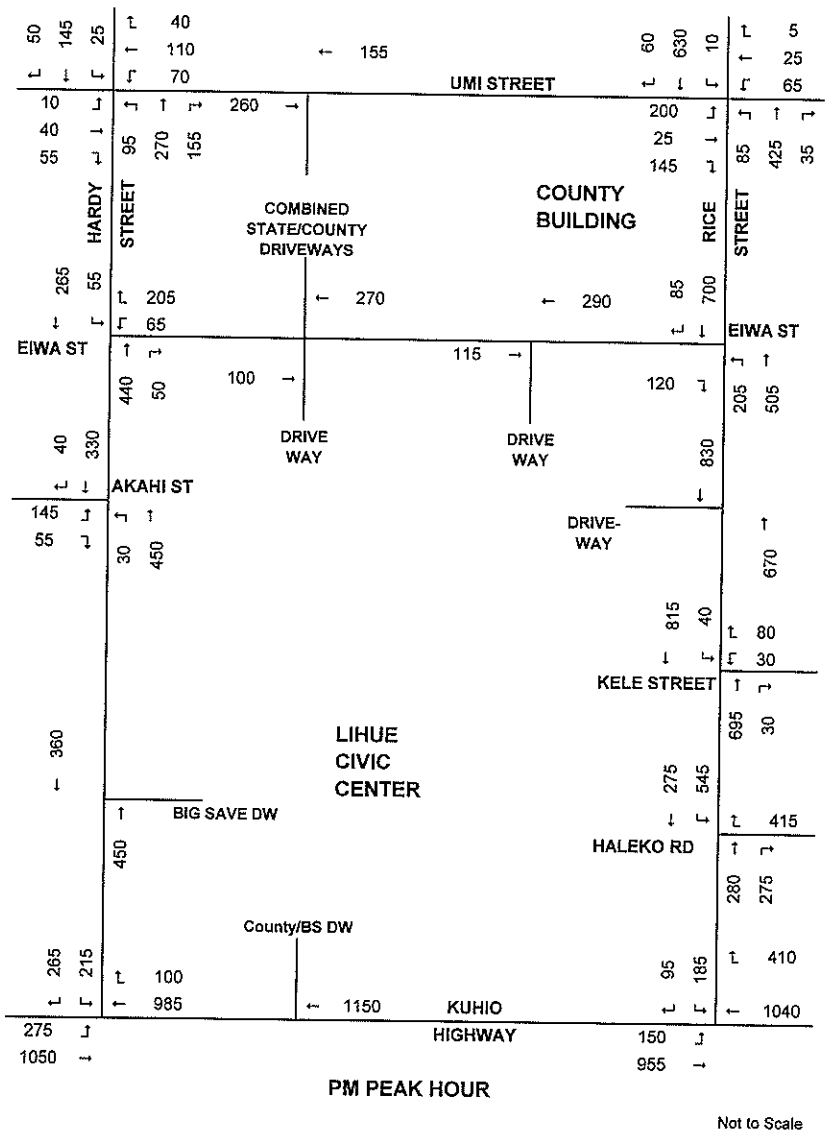
AMBIENT SCENARIO 1 THROUGH TRAFFIC FORECAST
FIGURE IV-5A



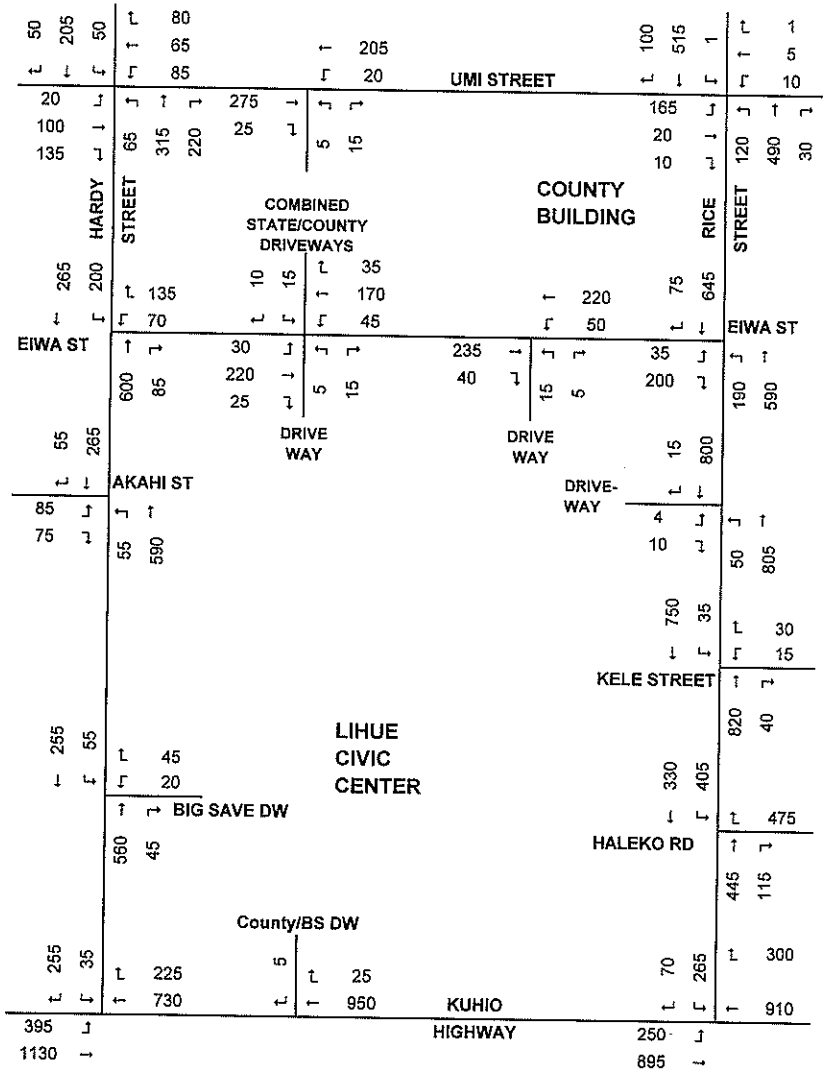
AMBIENT SCENARIO 1 THROUGH TRAFFIC FORECAST
FIGURE IV-5B



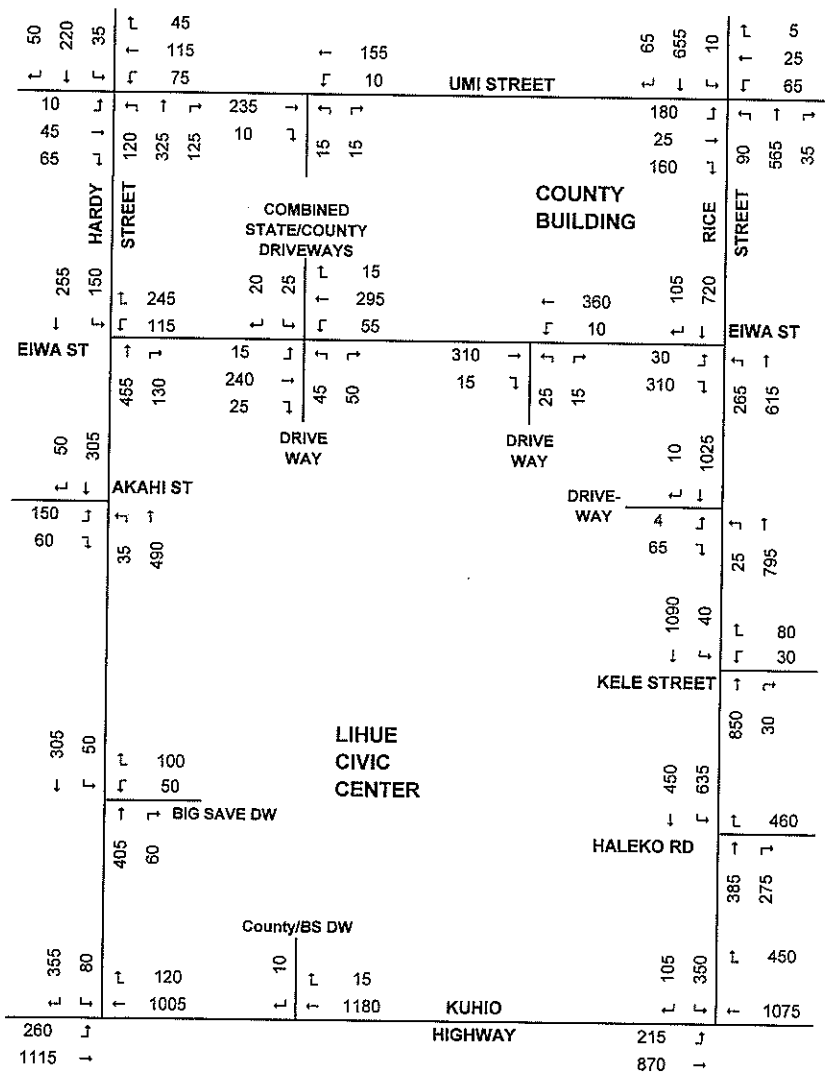
AMBIENT SCENARIO 2 THROUGH TRAFFIC FORECAST
FIGURE IV-6A



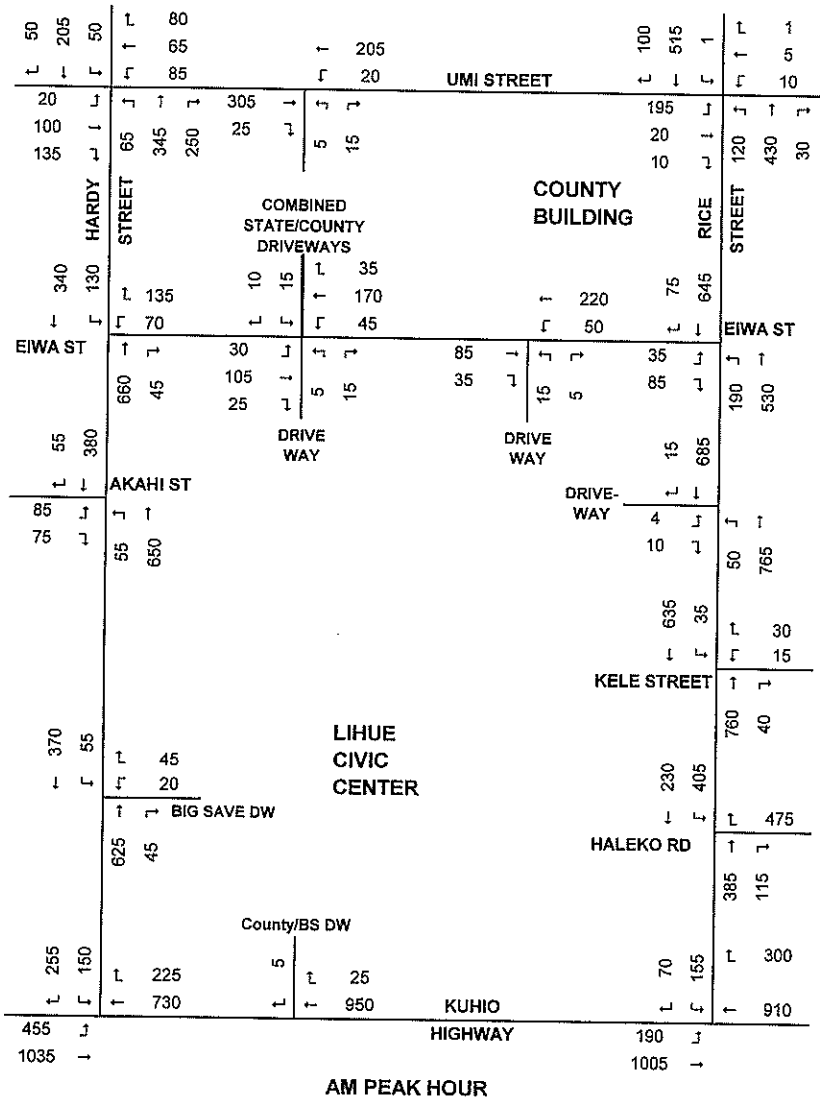
AMBIENT SCENARIO 2 THROUGH TRAFFIC FORECAST
FIGURE IV-6B



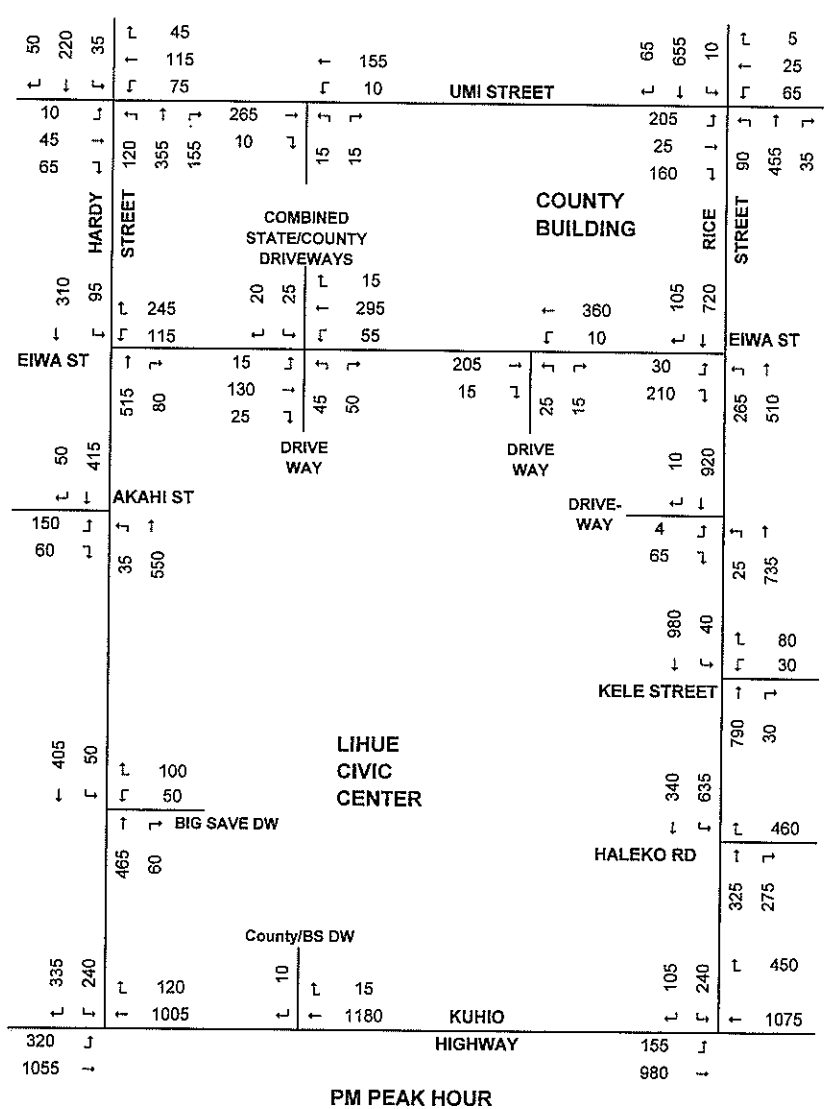
AMBIENT SCENARIO 1 COMBINED TRAFFIC FORECAST
FIGURE IV-7A



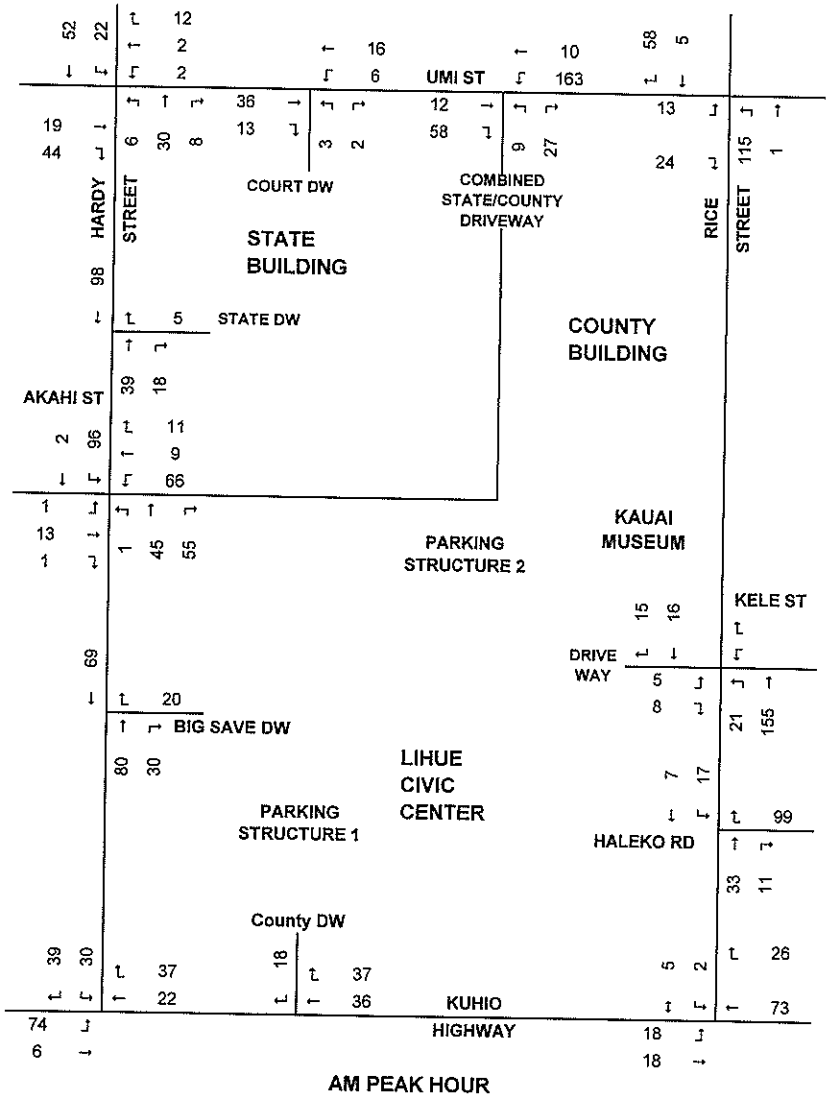
AMBIENT SCENARIO 1 COMBINED TRAFFIC FORECAST
FIGURE IV-7B



AMBIENT SCENARIO 2 COMBINED TRAFFIC FORECAST
FIGURE IV-8A



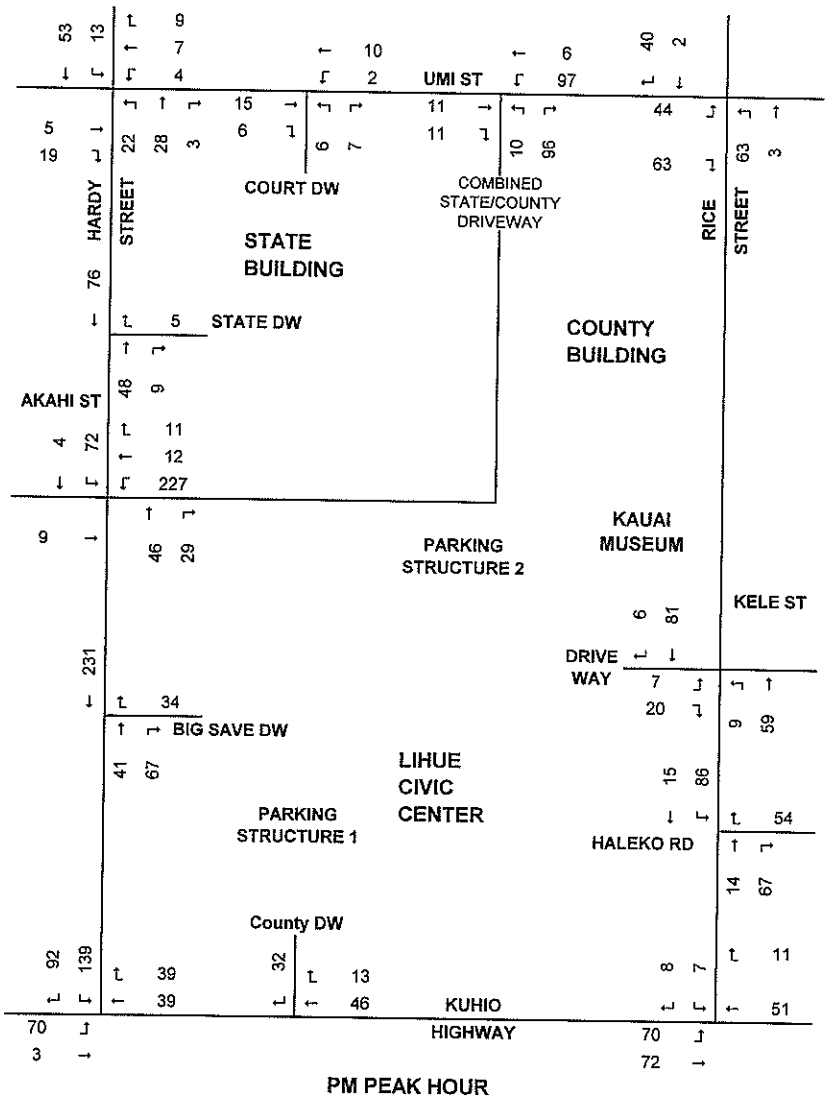
AMBIENT SCENARIO 2 COMBINED TRAFFIC FORECAST
FIGURE IV-8B



AM PEAK HOUR

Not to Scale

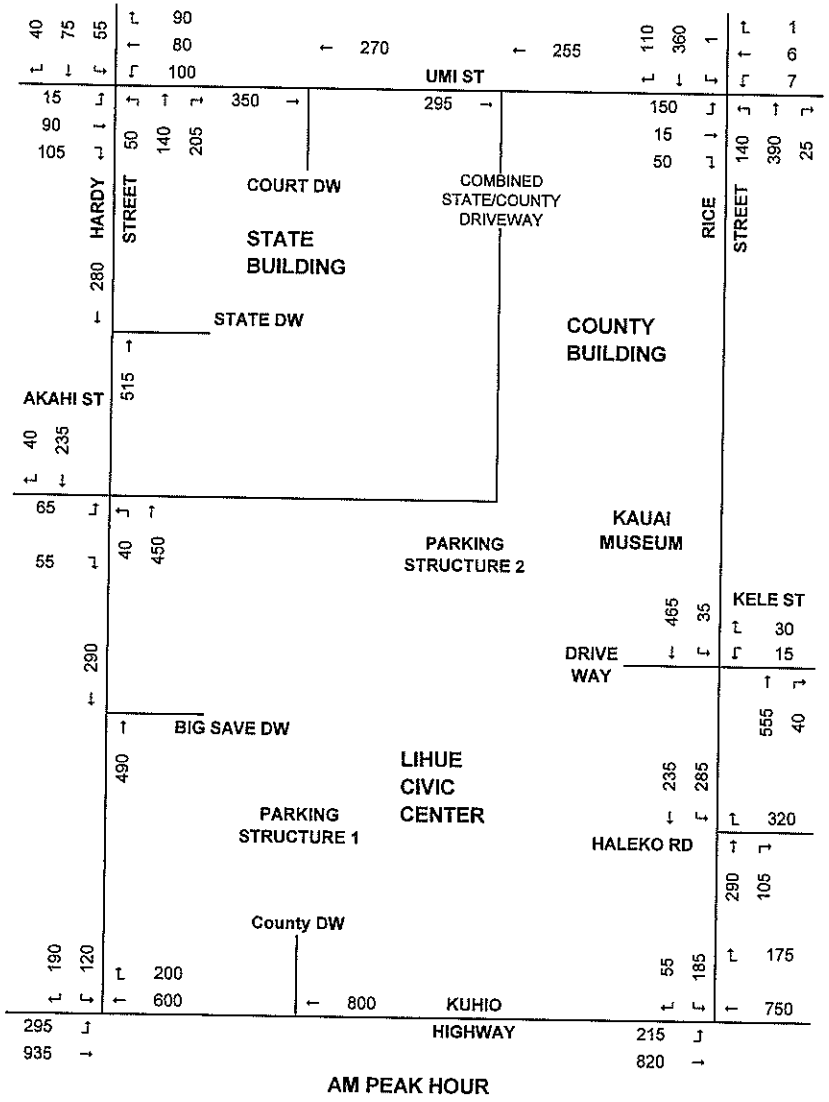
MASTER PLAN PARKING TRAFFIC ASSIGNMENT
FIGURE IV-9A



PM PEAK HOUR

Not to Scale

MASTER PLAN PARKING TRAFFIC ASSIGNMENT
FIGURE IV-9B



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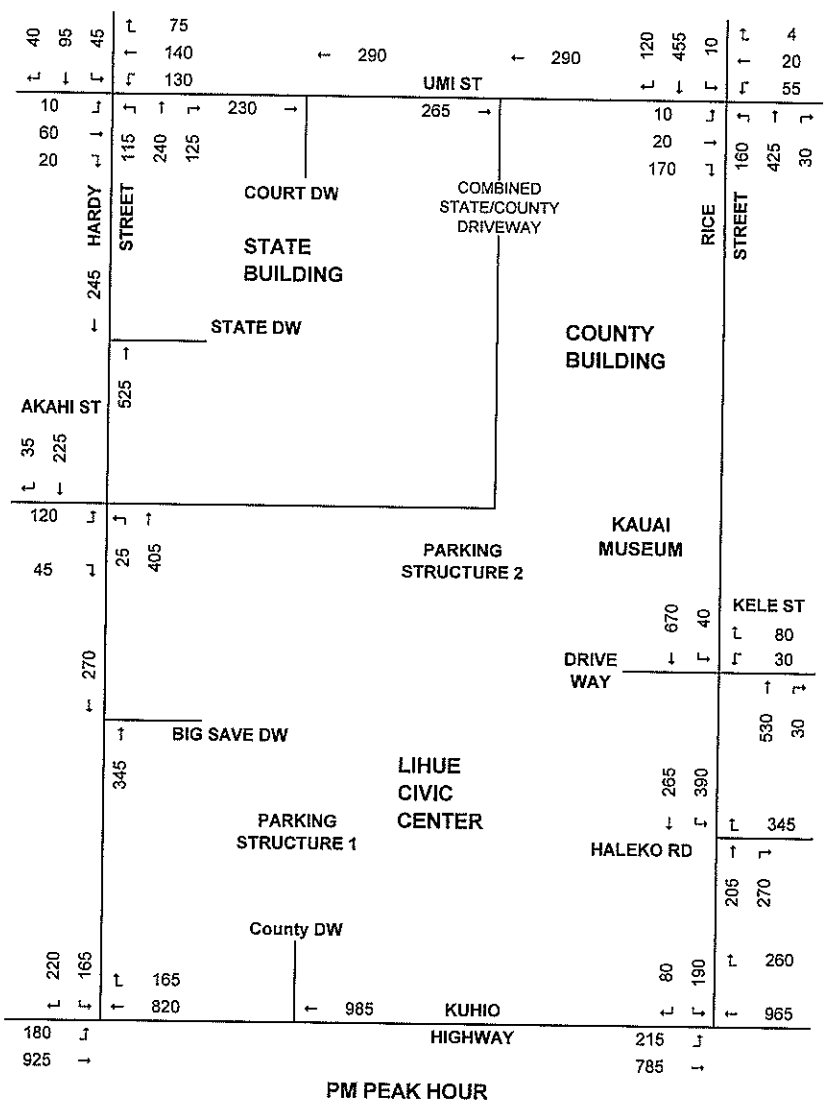
MASTER PLAN EXISTING THROUGH TRAFFIC ASSIGMENT
FIGURE IV-10A



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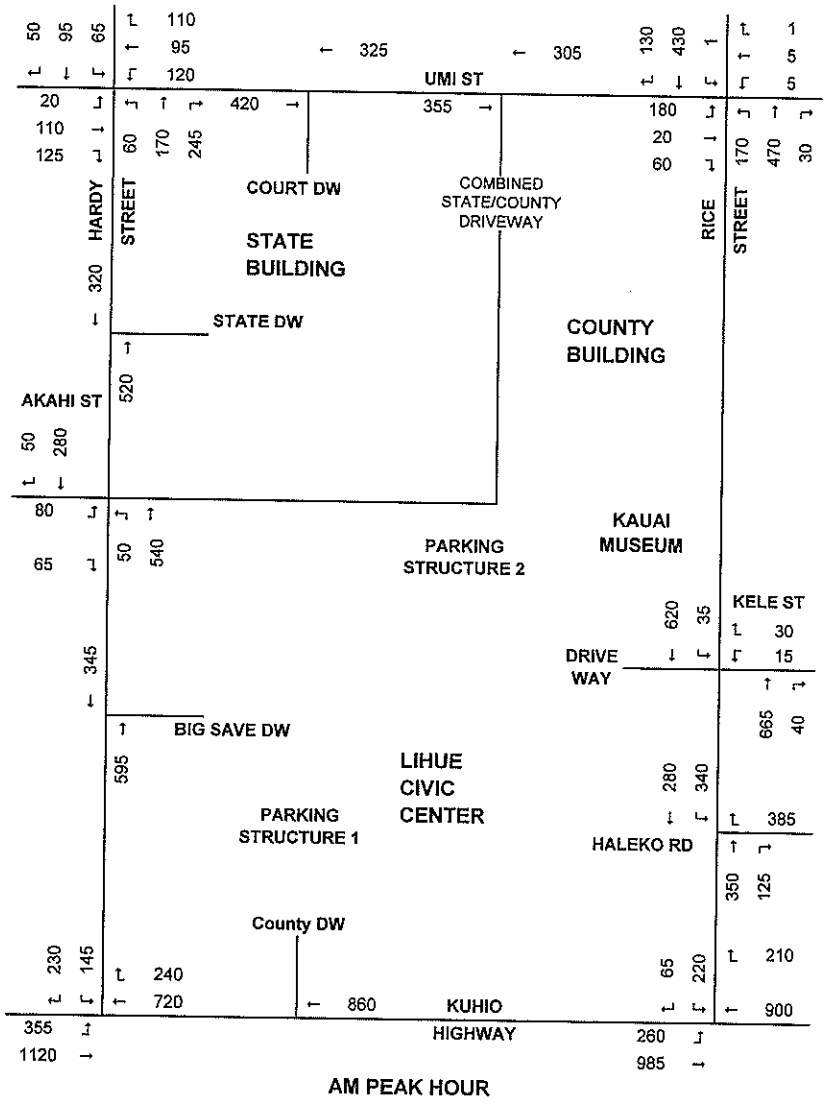
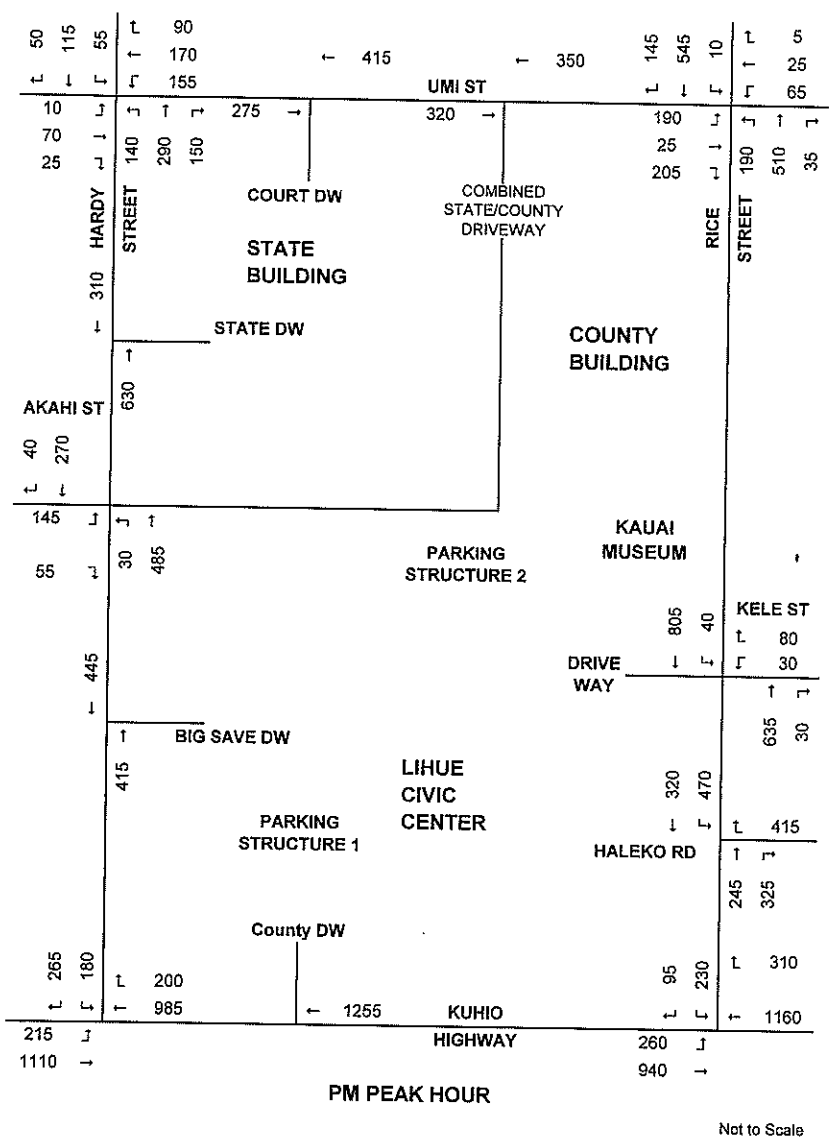
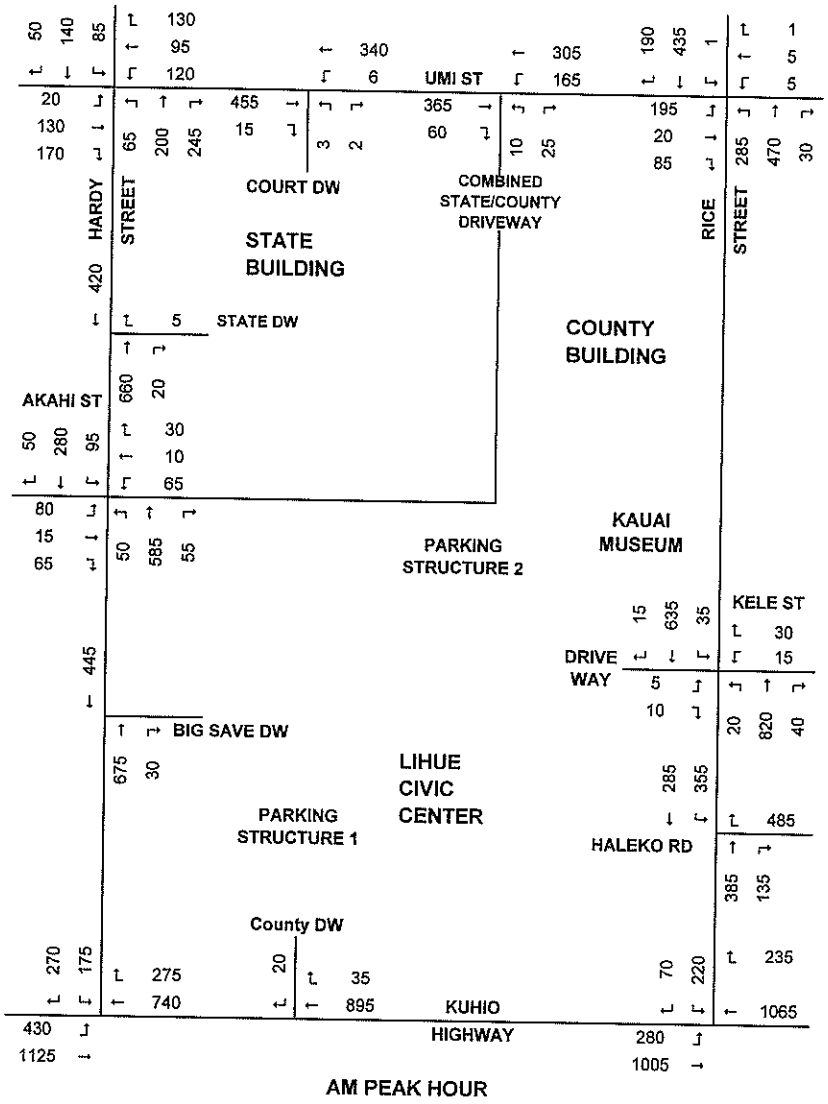
MASTER PLAN EXISTING THROUGH TRAFFIC ASSIGMENT
FIGURE IV-10B



MASTER PLAN FORECAST THROUGH TRAFFIC ASSIGMENT
FIGURE IV-11A



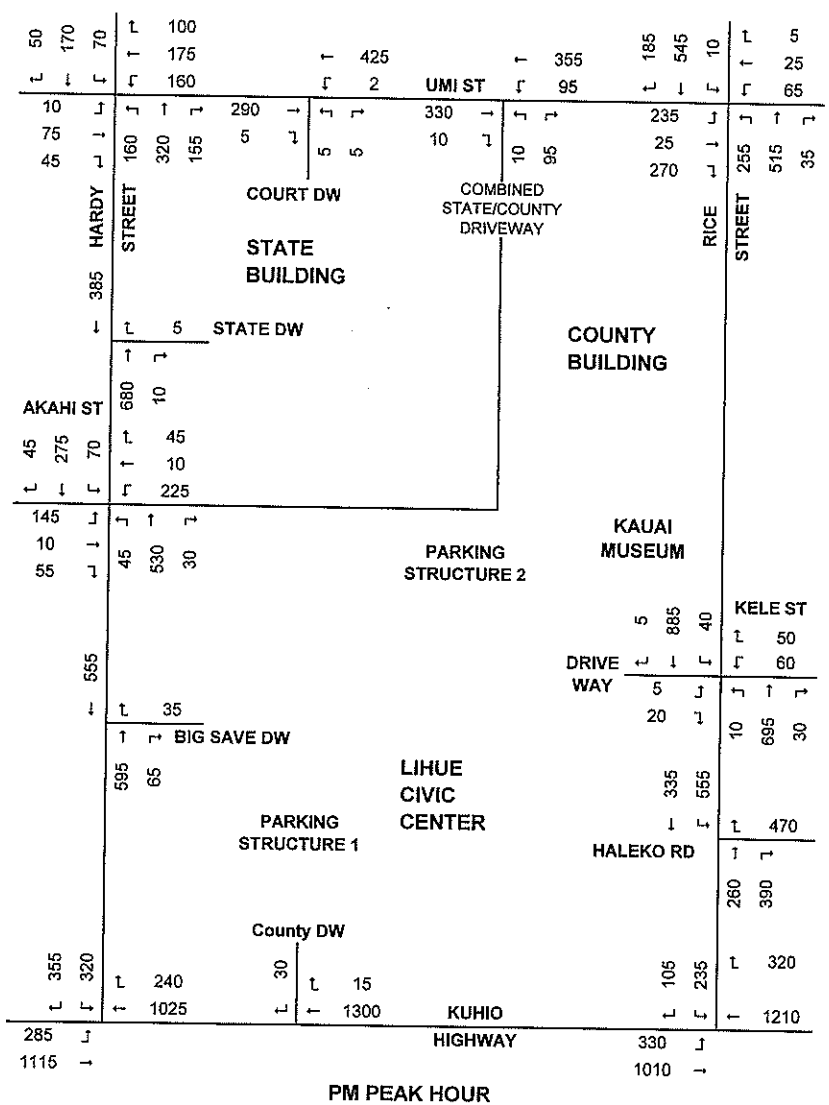
MASTER PLAN FORECAST THROUGH TRAFFIC ASSIGMENT
FIGURE IV-11B



AM PEAK HOUR

Not to Scale

MASTER PLAN COMBINED TRAFFIC FORECAST
FIGURE IV-12A



PM PEAK HOUR

Not to Scale

MASTER PLAN COMBINED TRAFFIC FORECAST
FIGURE IV-12B

Tables

TABLE II-1
EXISTING LEVEL OF SERVICE ANALYSES SUMMARY

INTERSECTION APPROACH	AM PEAK HOUR LOS	AM PEAK HOUR Delay	PM PEAK HOUR LOS	PM PEAK HOUR Delay
RICE STREET/UMI STREET				
SIGNALIZED INTERSECTION ANALYSIS				
Rice Street/Umi Street	B	11.2	B	12.8
Rice St EB	A	9.4	A	9.5
Rice St WB	A	8.4	A	8.8
Umi St NB	B	18.1	C	21.4
Umi St SB	C	24.6	C	24.7
RICE STREET/EIWA STREET				
UNSIGNALIZED INTERSECTION ANALYSIS				
Eiwa St SB	C	17.3	C	24.3
Eiwa St SB right	B	12.8	C	16.6
Eiwa St SB left	E	45.7	F	90.1
Rice St EB left	B	10.1	B	11.8
RICE STREET/KELE STREET				
UNSIGNALIZED INTERSECTION ANALYSIS				
Rice Street/Kele St/Driveway				
Kele St NB	C	22.2	F	78.3
Rice St WB LT	A	9.8	A	9.8
RICE STREET/COUNTY DRIVEWAY				
UNSIGNALIZED INTERSECTION ANALYSES				
County Driveway SB	B	11.0	B	13.0
Rice St EB LT	A	9.6	B	10.4
RICE STREET/HALEKO ROAD				
UNSIGNALIZED INTERSECTION ANALYSES				
Haleko Rd NB RT	E	39.6	E	38.1
Rice St WB LT	B	10.5	C	15.3
RICE STREET/KUHIO HIGHWAY				
SIGNALIZED INTERSECTION ANALYSIS				
Rice Street/Kuhio Highway	B	13.9	B	17.3
Rice St WB	D	36.9	D	45.7
Rice St WB LT	D	37.4	D	47.1
Kamualii Highway NB	B	13.4	B	15.3
Kuhio Hwy SB	A	8.6	A	9.4
Kuhio Hwy SB LT	B	15.0	B	18.4

TABLE II-1
EXISTING LEVEL OF SERVICE ANALYSES SUMMARY

INTERSECTION APPROACH	AM PEAK HOUR LOS	AM PEAK HOUR Delay	PM PEAK HOUR LOS	PM PEAK HOUR Delay
HARDY STREET/KUHIO HIGHWAY				
UNSIGNALIZED INTERSECTION ANALYSES				
Hardy St WB	F	100+	F	100+
Hardy St WB right	C	16.9	D	31.7
Hardy St WB left	F	100+	F	100+
Kuhio Hwy SB left	C	15.1	B	14.4
HARDY STREET/BIG SAVE DRIVEWAY				
UNSIGNALIZED INTERSECTION ANALYSES				
Big Save Driveway NB	C	16.2	C	19.0
Hardy St WB LT	A	8.9	A	8.4
HARDY STREET/AKAHI STREET				
UNSIGNALIZED INTERSECTION ANALYSES				
Akahi Street SB	B	10.0	B	10.8
Hardy St EB LT	A	8.1	A	8.2
HARDY STREET/EIWA STREET				
UNSIGNALIZED INTERSECTION ANALYSES				
Eiwa St NB	B	14.5	B	13.9
Hardy St WB left	A	9.8	A	8.9
HARDY STREET/UMI STREET				
UNSIGNALIZED INTERSECTION ANALYSES				
Umi St NB	F	54.7	E	45.4
Umi St NB R	B	11.1	B	10.3
Umi St NB TL	F	78.2	F	54.4
Umi St SB	C	25.0	D	25.6
Hardy St EB left	A	7.8	A	8.0
Hardy St WB left	A	8.5	A	8.2
UMI STREET/COUNTY-STATE DRIVEWAY				
UNSIGNALIZED INTERSECTION ANALYSES				
Driveway EB	B	10.5	B	10.1
Umi St NB LT				

NOTES: 1. Subapproach lanes of an approach are underlined
2. Movements with undesirable levels of service are higlighted.

TABLE IV-1
LEVEL OF SERVICE ANALYSES SUMMARY

INTERSECTION APPROACH	Existing LOS	Existing Delay	Ambient Scenario 1 LOS	Ambient Scenario 1 Delay	Ambient Scenario 2 LOS	Ambient Scenario 2 Delay	Recom. Plan LOS	Recom. Plan Delay	Existing LOS	Existing Delay	Ambient Scenario 1 LOS	Ambient Scenario 1 Delay	Ambient Scenario 2 LOS	Ambient Scenario 2 Delay	Recom. Plan LOS	Recom. Plan Delay
	AM PEAK HOUR								PM PEAK HOUR							
RICE STREET/UMI STREET																
SIGNALIZED INTERSECTION ANALYSIS																
Rice Street/Umi Street				*(w/ 2 phase signal)*												
Rice St EB	B	11.2	B	12.2	B	12.8	B	18.9	B	12.8	B	14.2	B	15.1	C	24.6
Rice St EB LT	A	9.4	B	10.9	B	10.3	C	23.6	A	9.5	B	10.9	B	12.4	C	28.4
Rice St EB left							D	44.7							E	65.6
Rice St WB	A	8.4	A	8.8	A	8.8	A	8.9	A	8.8	A	9.5	B	11.5	A	9.7
Umi St NB	B	18.1	B	18.3	B	18.3	B	18.1	C	21.4	C	24.1	B	19.9	C	27.2
Umi St SB	C	24.6	C	26.6	C	29.8	C	27.6	C	24.7	C	27.5	C	24.5	D	37.7
SIGNALIZED INTERSECTION ANALYSIS				*(w/ 3 phase signal and EB LT lane)*												
Rice Street/Umi Street							B	19.9							C	26.4
Rice St EB							B	19.1							C	25.2
Rice St EB LT							C	33.9							D	51.9
Rice St WB							B	14.9							B	17.5
Umi St NB							C	20.6							C	30.1
Umi St SB							C	32.2							D	39.9
RICE STREET/EIWA STREET																
UNSIGNALIZED INTERSECTION ANALYSIS																
Eiwa St SB	C	17.3	C	21.5	D	26.8			C	24.3	E	41.1	E	39.7		
Eiwa St SB right	B	12.8	B	14.6	B	12.0			C	16.6	C	22.1	C	16.4		
Eiwa St SB left	E	45.7	F	72.8	F	87.9			F	90.1	F	100+	F	100+		
Rice St EB left	B	10.1	B	11.0	B	11.0			B	11.8	B	13.2	B	13.2		

TABLE IV-1
LEVEL OF SERVICE ANALYSES SUMMARY

INTERSECTION APPROACH	AM PEAK HOUR Existing LOS	Delay	Ambient Scenario 1 LOS	Delay	Ambient Scenario 2 LOS	Delay	Recom. Plan LOS	Delay	PM PEAK HOUR Existing LOS	Delay	Ambient Scenario 1 LOS	Delay	Ambient Scenario 2 LOS	Delay	Recom. Plan LOS	Delay
RICE STREET/KELE STREET/COUNTY DRIVEWAY																
UNSIGNALIZED INTERSECTION ANALYSIS																
Rice Street/Kele St/Driveway (w/ left turns permitted)																
Kele St NB	C	22.2	D	29.2	C	24.1	E	41.9	F	78.3	F	100+	F	100+	F	78.6
County Driveway SB (for recommended plan)							C	20.5							C	22.2
Rice St EB LT							A	9.3							B	10.3
Rice St WB LT	A	9.8	B	10.4	B	10.1	B	10.4	A	9.8	B	10.5	B	10.2	A	9.7
Rice Street/Kele St/Driveway (w/ right turns only permitted)																
Kele St NB							B	12.5							B	12.6
County Driveway SB							B	10.8							B	12.4
Rice St EB LT							A	9.3							B	10.3
Rice St WB LT							B	10.4							A	9.7
SIGNALIZED INTERSECTION ANALYSIS																
Rice Street/Kele Street/Driveway (w/ left turns permitted)							A	8.4							A	9.3
Rice St EB							A	8.1							A	7.4
Rice St WB							A	7.4							A	8.5
Kele St NB							C	23.3							C	24.7
County Driveway SB							C	22.7							C	22.9
RICE STREET/COUNTY DRIVEWAY																
UNSIGNALIZED INTERSECTION ANALYSES																
County Driveway SB	B	11.0	B	11.7	B	11.0			B	13.0	B	14.3	B	13.4		
Rice St EB LT	A	9.6	B	10.3	A	9.7			B	10.4	B	11.3	B	10.7		

TABLE IV-1
LEVEL OF SERVICE ANALYSES SUMMARY

INTERSECTION APPROACH	AM PEAK HOUR Existing LOS	Delay	Ambient Scenario 1 LOS	Delay	Ambient Scenario 2 LOS	Delay	Recom. Plan LOS	Delay	PM PEAK HOUR Existing LOS	Delay	Ambient Scenario 1 LOS	Delay	Ambient Scenario 2 LOS	Delay	Recom. Plan LOS	Delay
RICE STREET/HALEKO ROAD																
UNSIGNALIZED INTERSECTION ANALYSES																
Rice Street/Haleko Road (current design)																
Haleko Rd NB RT	E	39.6	F	100+	F	71.7	F	83.2	E	38.1	F	100+	F	73.1	F	75.1
Rice St WB LT	B	10.5	B	12.2	B	11.5	B	11.1	C	15.3	D	25.1	C	21.0	C	18.6
Rice Street/Haleko Road (w/ separate through and right turn EB lanes)																
Haleko Rd NB RT							F	51.4							C	23.2
Rice St WB LT							B	11.1							C	18.6
SIGNALIZED INTERSECTION ANALYSIS																
Rice Street/Haleko Road (widened)							C	27.9							C	31.8
Rice St EB							C	32.7							D	38.2
Rice St WB							B	13.8							B	17.9
Rice ST WB LT							B	16.7							C	22.9
Haleko Rd NB R							D	44.2							D	54.4
RICE STREET/KUHIO HIGHWAY																
SIGNALIZED INTERSECTION ANALYSIS																
Rice Street/Kuhio Highway	B	13.9	B	17.7	B	13.2	C	21.4	B	17.3	C	24.0	B	16.2	B	18.0
Rice St WB	D	36.9	D	42.7	C	30.7	D	40.6	D	45.7	D	41.4	D	35.2	C	33.5
Rice St WB LT	D	37.4	D	44	C	31.4	D	41.7	D	47.1	D	43.3	D	36.6	C	33.2
Kamualii Highway NB	B	13.4	B	14.7	B	14.7	B	17.7	B	15.3	C	24.6	B	17.4	B	15.5
Kuhio Hwy SB	A	8.6	B	13.8	A	9.6	C	20.8	A	9.4	B	17.2	B	10.6	B	17.4
Kuhio Hwy SB LT	B	15.0	D	36.8	B	18.9	E	69.4	B	18.4	D	48.6	C	25.3	D	51.1

TABLE IV-1
LEVEL OF SERVICE ANALYSES SUMMARY

INTERSECTION APPROACH	AM PEAK HOUR Existing LOS	Delay	Ambient Scenario 1 LOS	Delay	Ambient Scenario 2 LOS	Delay	Recom. Plan LOS	Delay	PM PEAK HOUR Existing LOS	Delay	Ambient Scenario 1 LOS	Delay	Ambient Scenario 2 LOS	Delay	Recom. Plan LOS	Delay
HARDY STREET/KUHIO HIGHWAY																
UNSIGNALIZED INTERSECTION ANALYSES																
Hardy St WB	F	100+	F	100+					F	100+	F	100+				
Hardy St WB right	C	16.9	C	21.9					D	31.7	E	49.5				
Hardy St WB left	F	100+	F	100+					F	100+	F	100+				
Kuhio Hwy SB left	C	15.1	C	21.5					B	14.4	C	18.7				
SIGNALIZED INTERSECTION ANALYSIS																
Kuhio Highway/Hardy Street					B	18.6	B	15.2					C	20.8	C	22.3
Hardy St WB					C	27.2	C	31.9					C	29.1	C	26.5
Hardy St WB LT					C	24.8	C	28.3					C	25.1	C	25.1
Kuhio Hwy NB					B	16.7	B	14.1					C	24.0	C	25.0
Kuhio Hwy SB					B	17.7	B	11.6					B	15.3	B	18.2
Kuhio Hwy SB LT					D	48.0	C	32.2					D	46.1	E	57.5
HARDY STREET/BIG SAVE-COUNTY DRIVEWAY																
UNSIGNALIZED INTERSECTION ANALYSES																
Big Save Driveway NB	C	16.2	C	17.7	C	21.0			C	19.0	C	19.6	C	23.5		
Hardy St WB LT	A	8.9	A	9.2	A	9.5			A	8.4	A	8.6	A	8.9		
Big Save Driveway NB RT (if outbound right turns permitted)							C	15.3							B	14.0
Big Save Driveway NB (if outbound left and right turns permitted)							C	23.9							E	40.4
Hardy St WB LT (if inbound left turns permitted)							A	9.7							A	9.4

TABLE IV-1
LEVEL OF SERVICE ANALYSES SUMMARY

INTERSECTION APPROACH	AM PEAK HOUR Existing LOS	Delay	Ambient Scenario 1 LOS	Delay	Ambient Scenario 2 LOS	Delay	Recom. Plan LOS	Delay	PM PEAK HOUR Existing LOS	Delay	Ambient Scenario 1 LOS	Delay	Ambient Scenario 2 LOS	Delay	Recom. Plan LOS	Delay
HARDY STREET/AKAHI STREET/COUNTY DRIVEWAY																
UNSIGNALIZED INTERSECTION ANALYSES																
Hardy Street/Akahi Street/County Driveway	(w/ current two-lane design on Hardy St.)															
County DW NB							F	69.8							F	100+
County DW NB TR							C	19.9							C	17.4
County DW NB L							F	100+							F	100+
Akahi Street SB	B	10.0	D	29.5	F	50.5	F	89.6	B	10.8	F	57.0	F	74.0	F	100+
Hardy St EB LT	A	8.1	A	8.2	A	8.7	A	8.1	A	8.2	A	8.3	A	8.3	A	8.1
Hardy St WB LT							A	9.5							A	9.1
Hardy Street/Akahi Street/County Driveway	(w/ left turn lane on Hardy St. and 12% growth factor)															
County DW NB							F	64.8							F	100+
County DW NB TR							C	19.5							C	17.2
County DW NB L							F	95.4							F	100+
Akahi Street SB							F	81.3							F	100+
Hardy St EB LT							A	8.1							A	8.2
Hardy St WB LT							A	9.5							A	9.1
Hardy Street/Akahi Street/County Driveway	(w/ current two-lane design on Hardy St., four way stop and 12% growth factor)															
Overall intersection							F	68.0							F	100+
Hardy St EB							F	100+							F	100+
Hardy St WB							D	25.6							F	57.3
County Driveway NB							B	12.8							D	31.3
Akahi St SB							B	13.6							C	22.8

TABLE IV-1
LEVEL OF SERVICE ANALYSES SUMMARY

INTERSECTION APPROACH	AM PEAK HOUR Existing LOS	Delay	Ambient Scenario 1 LOS	Delay	Ambient Scenario 2 LOS	Delay	Recom. Plan LOS	Delay	PM PEAK HOUR Existing LOS	Delay	Ambient Scenario 1 LOS	Delay	Ambient Scenario 2 LOS	Delay	Recom. Plan LOS	Delay
Hardy Street/Akahi Street/County Driveway	(w/ left turn lane on Hardy St., four way stop and 12% growth factor)															
Overall intersection							F	56.6							F	76.7
Hardy St EB							F	99.4							F	100+
Hardy St WB							C	16.4							D	26.4
County Driveway NB							B	11.8							C	20.9
Akahi St SB							B	11.2							B	14.1
SIGNALIZED INTERSECTION ANALYSIS																
Hardy Street/Akahi Street/County Driveway	(w/ current two-lane design on Hardy St.)															
Overall intersection							B	14.7							B	16.5
Hardy St EB							B	15.1							B	12.1
Hardy St WB							B	10.9							A	9.5
County Driveway NB							B	18.8							C	29.3
Akahi St SB							C	20.6							C	25.5
Hardy Street/Akahi Street/County Driveway	(w/ left turn lane on Hardy St.)															
Overall intersection							B	12.1							B	15.3
Hardy St EB							B	11.7							B	10.2
Hardy St WB							A	8.1							A	7.9
County Driveway NB							B	18.8							C	29.3
Akahi St SB							C	20.6							C	25.5
HARDY STREET/EIWA STREET																
UNSIGNALIZED INTERSECTION ANALYSES																
Eiwa St NB	B	14.5	F	100+	F	100+			B	13.9	F	100+	F	100+		
Hardy St WB left	A	9.8	B	10.8	B	10.2			A	8.9	A	9.7	A	9.4		

TABLE IV-1
LEVEL OF SERVICE ANALYSES SUMMARY

INTERSECTION APPROACH	AM PEAK HOUR Existing LOS	Delay	Ambient Scenario 1 LOS	Delay	Ambient Scenario 2 LOS	Delay	Recom. Plan LOS	Delay	PM PEAK HOUR Existing LOS	Delay	Ambient Scenario 1 LOS	Delay	Ambient Scenario 2 LOS	Delay	Recom. Plan LOS	Delay
HARDY STREET/UMI STREET																
UNSIGNALIZED INTERSECTION ANALYSES																
Umi St NB	F	54.7	F	100+	F	100+	F	100+	E	45.4	F	100+	F	100+	F	100+
Umi St NB R	B	11.1	B	12.2	B	12.8	B	10.9	B	10.3	B	11.3	B	11.6	B	11.3
Umi St NB TL	F	78.2	F	100+	F	100+	F	100+	F	54.4	F	100+	F	100+	F	100+
Umi St SB	C	25.0	F	98.6	F	100+	D	34.2	D	25.6	E	39.3	E	45.2	F	86.3
Hardy St EB left	A	7.8	A	8.0	A	8.0	A	7.8	A	8.0	A	8.2	A	8.2	A	8.2
Hardy St WB left	A	8.5	A	8.9	A	9.2	A	8.7	A	8.2	A	8.5	A	8.6	A	8.8
ROUNDABOUT INTERSECTION ANALYSIS - utilization is measured by lowerbound volume/capacity ratio. Level of service is not calcuated.																
Hardy Street/Umi Street							v/c ratio								v/c ratio	
Hardy St EB							0.61								0.70	
Hardy St WB							0.34								0.45	
Umi St NB							0.43								0.67	
Umi St SB							0.43								0.18	
UMI STREET/COUNTY-STATE DRIVEWAY																
UNSIGNALIZED INTERSECTION ANALYSES																
Driveway EB	B	10.5	B	10.9	B	11.4	C	15.3	B	10.1	B	10.8	B	11.1	B	12.2
Driveway EB RT							B	11.1							B	11.4
Driveway EB LT							C	26.0							C	19.9
Umi St NB LT							A	9.0							A	8.4

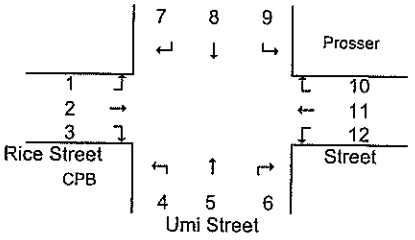
NOTES: 1. Subapproach lanes of an approach are underlined.
2. Movements with undesirable levels of service are higlighted.
3. Alternative mitigation measures are analyzed for intersections with poor levels of service.
4. Ambient scenario 1 is current roadway conditions with opening of Ka'ana Street extension.
5. Ambient scenario 2 is ambient scenario 1 with traffic signal installed at Kuhio Highway/Harding Street intersection.

Appendix A

Traffic Turning Movement Counts

TRAFFIC TURNING MOVEMENT COUNT
Lihue Civic Center Master Plan

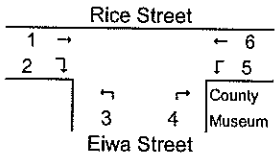
LOCATION: Rice Street/Umi Street
DATE: October 7, 2003; Tuesday
TIME: 7:00a-9:00a/3:00p-5:00p
WEATHER: partly cloudy
RECORDER: H. Funamura, M. Paea



TIME	MOVEMENT NUMBER												
PERIOD	1	2	3	4	5	6	7	8	9	10	11	12	TOTAL
7:00-7:15	0	71	13	16	0	16	0	0	3	1	82	12	214
7:15-7:30	1	93	20	25	4	25	0	1	1	1	83	31	285
7:30-7:45	0	135	31	50	5	35	0	1	4	10	110	43	424
7:45-8:00	0	132	18	39	4	38	0	1	1	5	110	14	362
8:00-8:15	0	82	14	30	1	13	1	3	1	9	106	14	274
8:15-8:30	3	100	17	27	3	14	1	2	3	4	100	10	284
8:30-8:45	1	103	8	26	8	17	1	3	2	11	93	5	278
8:45-9:00	2	90	13	18	7	20	2	5	4	10	116	10	297
7:00-9:00	7	806	134	231	32	178	5	16	19	51	800	139	2418
7:15-8:15	1	442	83	144	14	111	1	6	7	25	409	102	1345
PHF	0.79			0.75						0.82			
3:00-3:15	1	139	16	27	2	21	1	3	7	13	127	11	368
3:15-3:30	3	147	18	29	11	18	3	0	16	12	121	18	396
3:30-3:45	1	146	19	25	3	18	2	4	6	10	124	9	367
3:45-4:00	1	125	15	22	4	22	0	8	13	13	134	13	370
4:00-4:15	2	140	18	31	6	31	1	5	14	7	97	21	373
4:15-4:30	2	126	9	37	4	21	1	2	13	4	123	16	358
4:30-4:45	2	154	19	36	7	47	2	9	23	7	133	17	456
4:45-5:00	2	133	10	45	5	34	0	5	7	12	129	20	402
3:00-5:00	14	1110	124	252	42	212	10	36	99	78	988	125	3090
3:30-4:30	6	557	68	103	20	79	6	15	42	48	506	51	1501
4:00-5:00	8	553	56	149	22	133	4	21	57	30	482	74	1589
PHF	0.88			0.90						0.91			

TRAFFIC TURNING MOVEMENT COUNT
Lihue Civic Center Master Plan

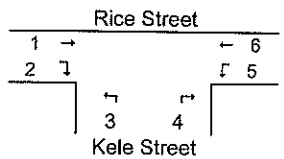
LOCATION: Rice Street/Eiwa Street
DATE: September 30, 2003; Tuesday
TIME: 7:00a-9:00a/3:00p-5:00p
WEATHER: sunny
RECORDER: H. Funamura



TIME PERIOD	MOVEMENT NUMBER 1	2	3	4	5	6	TOTAL
7:00-7:15	76	15	7	15	28	112	253
7:15-7:30	126	11	6	32	27	131	333
7:30-7:45	164	23	5	49	56	149	446
7:45-8:00	140	23	7	54	53	107	384
8:00-8:15	108	16	10	36	38	109	317
8:15-8:30	88	24	8	45	27	98	290
8:30-8:45	106	20	11	43	35	115	330
8:45-9:00	99	35	12	37	37	127	347
7:00-9:00	907	167	66	311	301	948	2700
7:15-8:15	538	73	28	171	174	496	1480
PHF	0.82		0.82		0.82		
3:00-3:15	136	20	8	66	64	132	426
3:15-3:30	120	16	14	60	61	133	404
3:30-3:45	151	22	8	69	63	127	440
3:45-4:00	154	25	7	65	56	146	453
4:00-4:15	138	29	9	57	53	109	395
4:15-4:30	152	19	9	68	49	147	444
4:30-4:45	177	27	7	78	69	141	499
4:45-5:00	140	19	9	68	61	117	414
3:00-5:00	1168	177	71	531	476	1052	3475
4:00-5:00	607	94	34	271	232	514	1752
PHF	0.86		0.90		0.89		

TRAFFIC TURNING MOVEMENT COUNT
Lihue Civic Center Master Plan

LOCATION: Rice Street/Kele Street
DATE: December 16, 2004
TIME: 7:00a-9:00a/3:00p-5:00p
WEATHER: partly cloudy
RECORDER: H. Funamura

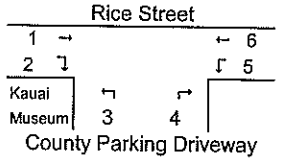


TIME PERIOD	MOVEMENT NUMBER 1	2	3	4	5	6	TOTAL
7:00-7:15	109	5	2	6	2	70	194
7:15-7:30	156	4	1	6	5	135	307
7:30-7:45	234	7	5	5	6	187	444
7:45-8:00	175	8	4	13	12	175	387
8:00-8:15	144	19	7	8	12	135	325
8:15-8:30	135	17	6	13	17	113	301
8:30-8:45	119	13	6	22	14	126	300
8:45-9:00	111	8	5	23	11	120	278
7:00-9:00	1183	81	36	96	79	1061	2536
7:15-8:15	709	38	17	32	35	632	1463
PHF	0.77		0.82		0.86		
8:00-9:00	509	57	24	66	54	494	1204
3:00-3:15	180	24	4	27	22	178	435
3:15-3:30	154	21	9	44	20	206	454
3:30-3:45	194	15	6	38	28	239	520
3:45-4:00	185	12	8	28	22	223	478
4:00-4:15	204	5	9	32	16	231	497
4:15-4:30	169	8	5	18	6	229	435
4:30-4:45	184	10	9	20	6	257	486
4:45-5:00	163	5	7	11	10	207	403
3:00-5:00	1433	100	57	218	130	1770	3708
4:00-5:00	720	28	30	81	38	924	1821
PHF	0.96		0.96		0.91		
3:00-4:00	713	72	27	137	92	846	1887

Post office hours- 8:00 am to 4:00 pm
First Hawaiian Bank hours- 8:30 am to 4:00 pm

TRAFFIC TURNING MOVEMENT COUNT
Lihue Civic Center Master Plan

LOCATION: Rice Street/County Parking Drwy
DATE: October 2, 2003; Thursday
TIME: 7:00a-9:00a/3:00p-5:00p
WEATHER: rain in AM; cloudy in PM
RECORDER: H. Funamura

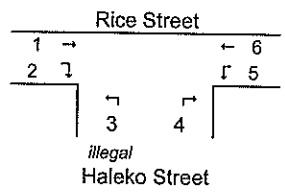


TIME PERIOD	MOVEMENT NUMBER 1	2	3	4	5	6	TOTAL
7:00-7:15	112	1	0	2	7	121	243
7:15-7:30	140	2	0	4	19	163	328
7:30-7:45	197	5	0	3	13	228	446
7:45-8:00	194	4	2	4	19	165	388
8:00-8:15	139	4	2	0	0	134	279
8:15-8:30	95	1	1	10	14	139	260
8:30-8:45	144	6	1	8	4	138	301
8:45-9:00	141	2	0	3	5	138	289
7:00-9:00	1162	25	6	34	81	1226	2534
7:15-8:15	670	15	4	11	51	690	1441
PHF	0.85				0.77		
3:00-3:15	185	8	1	7	8	194	403
3:15-3:30	186	4	3	9	9	195	406
3:30-3:45	195	6	1	11	6	155	374
3:45-4:00	191	7	2	20	5	185	410
4:00-4:15	225	4	0	12	14	168	423
4:15-4:30	183	4	1	19	4	162	373
4:30-4:45	272	1	2	25	6	175	481
4:45-5:00	189	1	1	10	2	172	375
3:00-5:00	1626	35	11	113	54	1406	3245
4:00-5:00	869	10	4	66	26	677	1652
PHF	0.80				0.97		

NOTE: This count was take just prior to the County's placing plastic delineators to prevent left turns across Rice Street.

TRAFFIC TURNING MOVEMENT COUNT
Lihue Civic Center Master Plan

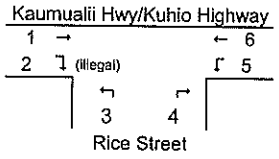
LOCATION: Rice Street/Haleko Street
DATE: October 14, 2003; Tuesday
TIME: 7:00a-9:00a/3:00p-5:00p
WEATHER: cloudy and rain
RECORDER: H. Funamura



TIME PERIOD	MOVEMENT NUMBER 1	2	3	4	5	6	TOTAL
7:00-7:15	85	17		49	46	50	247
7:15-7:30	87	25		91	58	65	326
7:30-7:45	103	29		138	119	78	467
7:45-8:00	103	21		85	103	83	395
8:00-8:15	89	20		97	60	56	322
8:15-8:30	88	24		60	56	59	287
8:30-8:45	128	19		64	73	60	344
8:45-9:00	97	16		61	98	87	359
7:00-9:00	780	171	0	645	613	538	2747
7:15-8:15	382	95	0	411	340	282	1510
PHF	0.90			0.74	0.79		
3:00-3:15	106	24		87	87	84	388
3:15-3:30	104	25		99	114	87	429
3:30-3:45	84	31	2	87	101	117	422
3:45-4:00	82	22	1	103	114	94	416
4:00-4:15	83	47		117	129	96	472
4:15-4:30	82	37		93	116	93	421
4:30-4:45	85	61		94	163	113	516
4:45-5:00	79	85		88	138	83	473
3:00-5:00	705	332	3	768	962	767	3537
4:00-5:00	329	230	0	392	546	385	1882
PHF	0.85			0.84	0.84		

TRAFFIC TURNING MOVEMENT COUNT
Lihue Civic Center Master Plan

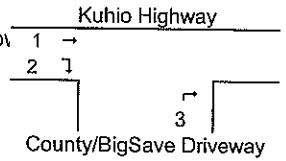
LOCATION: Kuhio Hwy/Kaumualii Hwy/Rice St
DATE: October 1, 2003; Wednesday
TIME: 7:00a-9:00a/3:00p-5:00p
WEATHER: partly cloudy
RECORDER: H. Funamura



TIME PERIOD	MOVEMENT NUMBER 1	2	3	4	5	6	TOTAL
7:00-7:15	162		41	8	33	178	422
7:15-7:30	187		56	11	43	214	511
7:30-7:45	205		51	23	63	199	541
7:45-8:00	205		72	12	63	184	536
8:00-8:15	168		44	13	48	148	421
8:15-8:30	168		25	16	48	126	383
8:30-8:45	178		81	23	56	143	481
8:45-9:00	156		57	17	63	157	452
7:00-9:00	1431	0	427	123	417	1349	3747
7:15-8:15	765	0	223	59	217	745	2009
PHF	0.93		0.84		0.92		
3:00-3:15	225		59	31	43	133	491
3:15-3:30	209		72	20	62	168	531
3:30-3:45	207		78	28	51	164	528
3:45-4:00	214		71	18	43	185	531
4:00-4:15	219		86	25	39	192	561
4:15-4:30	241		63	17	39	196	556
4:30-4:45	223		88	29	53	173	566
4:45-5:00	218		64	20	47	168	517
3:00-5:00	1756	0	581	188	377	1379	4281
4:00-5:00	901	0	301	91	178	729	2200
PHF	0.93		0.84		0.96		

TRAFFIC TURNING MOVEMENT COUNT
Lihue Civic Center Master Plan

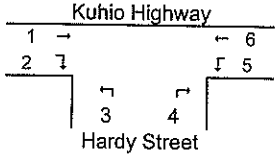
LOCATION: Kuhio Highway-County/BigSave Dr
DATE: December 10, 2004; Friday
TIME: 7:00a-9:00a/3:00p-5:00p
WEATHER: cloudy
RECORDER: H. Funamura



TIME PERIOD	MOVEMENT NUMBER 1	2	3	4	5	6	TOTAL
7:00-7:15	197	7	0				204
7:15-7:30	217	8	2				227
7:30-7:45	226	6	3				235
7:45-8:00	247	6	5				258
8:00-8:15	202	4	1				207
8:15-8:30	174	4	3				181
8:30-8:45	193	3	4				200
8:45-9:00	162	5	1				168
7:00-9:00	1618	43	19	0	0	0	1680
7:15-8:15	892	24	11	0	0	0	927

TRAFFIC TURNING MOVEMENT COUNT
Lihue Civic Center Master Plan

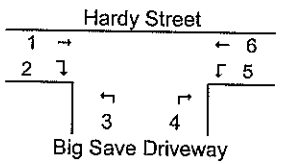
LOCATION: Kuhio Hwy/Hardy St
DATE: September 25, 2003; Thursday
TIME: 7:00a-9:00a/3:00p-5:00p
WEATHER: light rain
RECORDER: H. Funamura



TIME PERIOD	MOVEMENT NUMBER 1	2	3	4	5	6	TOTAL
7:00-7:15	148	32	10	28	58	235	511
7:15-7:30	135	54	10	55	85	249	588
7:30-7:45	161	81	7	51	125	253	678
7:45-8:00	150	30	8	77	70	238	573
8:00-8:15	169	27	7	46	76	206	531
8:15-8:30	145	17	8	59	61	202	492
8:30-8:45	149	22	9	58	67	181	486
8:45-9:00	137	26	5	43	57	186	454
7:00-9:00	1194	289	64	417	599	1750	4313
7:15-8:15	615	192	32	229	356	946	2370
PHF	0.83		0.77		0.86		
3:00-3:15	180	29	17	99	63	205	593
3:15-3:30	226	35	12	91	69	207	640
3:30-3:45	227	28	15	79	67	258	674
3:45-4:00	215	24	17	72	63	206	597
4:00-4:15	200	22	14	83	51	236	606
4:15-4:30	228	23	14	77	55	259	656
4:30-4:45	222	32	30	97	67	213	661
4:45-5:00	195	30	11	76	69	222	603
3:00-5:00	1693	223	130	674	504	1806	5030
4:00-5:00	845	107	69	333	242	930	2526
PHF	0.95		0.79		0.93		

TRAFFIC TURNING MOVEMENT COUNT
Lihue Civic Center Master Plan

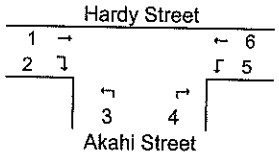
LOCATION: Hardy Street/Big Save Driveway
DATE: December 14, 2004
TIME: 7:00a-9:00a/3:00p-5:00p
WEATHER: clear
RECORDER: H. Funamura



TIME PERIOD	MOVEMENT NUMBER 1	2	3	4	5	6	TOTAL
7:00-7:15	65	6	1	5	3	28	108
7:15-7:30	99	15	2	8	9	40	173
7:30-7:45	177	18	8	10	15	67	295
7:45-8:00	117	8	7	8	9	72	221
8:00-8:15	86	15	7	7	11	44	170
8:15-8:30	62	10	12	9	6	46	145
8:30-8:45	71	19	8	5	7	47	157
8:45-9:00	69	14	8	13	10	42	156
7:00-9:00	746	105	53	65	70	386	1425
7:15-8:15	479	56	24	33	44	223	859
PHF	0.69		0.79		0.81		
3:00-3:15	87	10	14	19	16	71	217
3:15-3:30	90	17	13	25	10	78	233
3:30-3:45	82	12	21	9	7	68	199
3:45-4:00	67	18	16	17	10	58	186
4:00-4:15	83	12	16	20	8	81	220
4:15-4:30	77	13	12	11	8	81	202
4:30-4:45	118	25	23	29	11	82	288
4:45-5:00	69	18	18	16	13	83	217
3:00-5:00	673	125	133	146	83	602	1762
4:00-5:00	347	68	69	76	40	327	927
PHF	0.73		0.70		0.99		

TRAFFIC TURNING MOVEMENT COUNT
Lihue Civic Center Master Plan

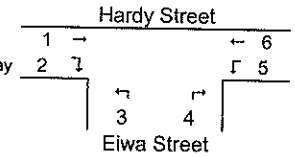
LOCATION: Hardy Street/Akahi Street
DATE: September 23, 2003; Tuesday
TIME: 7:00a-9:00a/3:00p-5:00p
WEATHER: sunny
RECORDER: H. Funamura



TIME PERIOD	MOVEMENT NUMBER 1	2	3	4	5	6	TOTAL
7:00-7:15	28	1	16	10	7	45	107
7:15-7:30	29	8	19	16	10	83	165
7:30-7:45	43	11	15	21	12	86	188
7:45-8:00	48	11	17	16	13	80	185
8:00-8:15	44	16	19	11	9	71	170
8:15-8:30	36	19	23	11	14	81	184
8:30-8:45	52	19	29	9	8	54	171
8:45-9:00	41	13	32	12	15	70	183
7:00-9:00	321	98	170	106	88	570	1353
7:15-8:15	164	46	70	64	44	320	708
PHF	0.89		0.93		0.93		
3:00-3:15	57	9	24	11	11	68	180
3:15-3:30	58	12	32	12	5	84	203
3:30-3:45	60	13	29	16	12	96	226
3:45-4:00	66	18	27	12	12	84	219
4:00-4:15	67	6	21	12	6	94	206
4:15-4:30	72	12	38	10	4	109	245
4:30-4:45	72	12	29	14	10	121	258
4:45-5:00	77	13	36	12	9	79	226
3:00-5:00	529	95	236	99	69	735	1763
4:00-5:00	288	43	124	48	29	403	935
PHF	0.92		0.90		0.82		

TRAFFIC TURNING MOVEMENT COUNT
Lihue Civic Center Master Plan

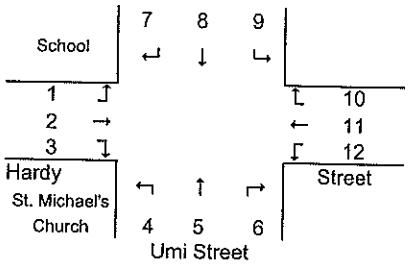
LOCATION: Hardy Street/Eiwa Street
DATE: September 24, 2003; Wednesday
TIME: 7:00a-9:00a/3:00p-5:00p
WEATHER: sunny in morn, cloudy in pm
RECORDER: H. Funamura



TIME PERIOD	MOVEMENT NUMBER 1	2	3	4	5	6	TOTAL
7:00-7:15	74	21	11	13	22	34	175
7:15-7:30	146	11	9	24	29	56	275
7:30-7:45	177	29	11	34	55	74	380
7:45-8:00	95	24	27	32	63	57	298
8:00-8:15	78	20	17	21	20	35	191
8:15-8:30	65	23	24	29	25	45	211
8:30-8:45	58	19	27	34	10	41	189
8:45-9:00	65	30	31	25	24	42	217
7:00-9:00	758	177	157	212	248	384	1936
7:15-8:15	496	84	64	111	167	222	1144
PHF	0.70		0.74		0.75		
3:00-3:15	47	15	35	39	30	33	199
3:15-3:30	87	19	22	48	25	53	254
3:30-3:45	92	29	28	49	21	48	267
3:45-4:00	86	30	30	48	24	47	265
4:00-4:15	90	26	25	48	31	53	273
4:15-4:30	103	25	37	37	38	54	294
4:30-4:45	103	33	35	53	22	54	300
4:45-5:00	69	36	34	43	30	45	257
3:00-5:00	677	213	246	365	221	387	2109
4:00-5:00	365	120	131	181	121	206	1124
PHF	0.89		0.89		0.89		

TRAFFIC TURNING MOVEMENT COUNT
Lihue Civic Center Master Plan

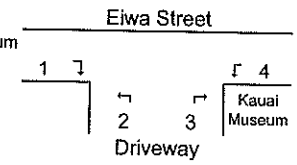
LOCATION: Hardy Street/Umi Street
DATE: October 8, 2003; Wednesday
TIME: 7:00a-9:00a/3:00p-5:00p
WEATHER: partly cloudy
RECORDER: H. Funamura, M. Paea



TIME PERIOD	MOVEMENT NUMBER 1	2	3	4	5	6	7	8	9	10	11	12	TOTAL
7:00-7:15	8	23	4	3	22	12	6	12	9	45	30	12	186
7:15-7:30	15	41	6	5	20	11	23	12	17	51	79	9	289
7:30-7:45	15	54	15	4	29	44	22	22	23	69	99	11	407
7:45-8:00	9	36	13	4	20	39	15	15	25	34	38	22	270
8:00-8:15	4	31	7	1	15	33	4	7	4	32	38	11	187
8:15-8:30	6	31	4	0	16	20	1	7	9	27	36	18	175
8:30-8:45	8	29	8	1	13	18	4	9	11	25	32	13	171
8:45-9:00	4	20	1	3	9	23	2	14	8	33	27	17	161
7:00-9:00	69	265	58	21	144	200	77	98	106	316	379	113	1846
7:15-8:15	43	162	41	14	84	127	64	56	69	186	254	53	1153
PHF	0.73			0.73			0.71			0.69			
3:00-3:15	1	31	5	4	0	19	5	22	12	22	37	25	183
3:15-3:30	9	30	6	0	17	18	7	13	9	26	45	26	206
3:30-3:45	15	18	10	2	7	9	11	19	9	30	61	25	216
3:45-4:00	2	41	13	1	12	10	14	26	8	30	54	23	234
4:00-4:15	3	40	3	2	10	17	8	16	17	23	47	25	211
4:15-4:30	13	36	8	2	10	17	10	19	12	38	57	20	242
4:30-4:45	10	50	14	2	5	15	10	37	20	26	74	32	295
4:45-5:00	5	46	16	2	13	12	9	24	16	18	55	26	242
3:00-5:00	58	292	75	15	74	117	74	176	103	213	430	202	1829
4:00-5:00	31	172	41	8	38	61	37	96	65	105	233	103	990
PHF	0.82						0.74			0.84			

TRAFFIC TURNING MOVEMENT COUNT
Lihue Civic Center Master Plan

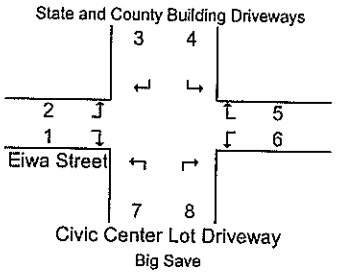
LOCATION: Eiwa Street- Driveway by Museum
DATE: October 9, 2003; Thursday
TIME: 7:00a-9:00a/3:00p-5:00p
WEATHER: overcast in AM; sunny in PM
RECORDER: H. Funamura



TIME PERIOD	MOVEMENT NUMBER 1	2	3	4	5	6	TOTAL
7:00-7:15	9	1	0	7			17
7:15-7:30	7	1	1	10			19
7:30-7:45	16	1	2	21			40
7:45-8:00	9	3	2	13			27
8:00-8:15	4	9	2	9			24
8:15-8:30	7	4	6	10			27
8:30-8:45	2	8	2	11			23
8:45-9:00	7	4	2	4			17
7:00-9:00	61	31	17	85	0	0	194
7:15-8:15	36	14	7	53	0	0	110
3:00-3:15	2	6	4	7			19
3:15-3:30	1	5	4	11			21
3:30-3:45	1	1	2	7			11
3:45-4:00	7	13	5	7			32
4:00-4:15	1	2	7	5			15
4:15-4:30	2	7	2	3			14
4:30-4:45	5	11	3	4			23
4:45-5:00	3	5	1	3			12
3:00-5:00	22	50	28	47	0	0	147
4:00-5:00	11	25	13	15	0	0	64

TRAFFIC TURNING MOVEMENT COUNT
Lihue Civic Center Master Plan

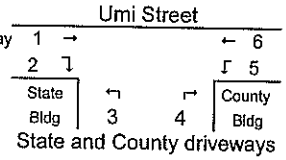
LOCATION: Eiwa Street- County and State Bldg driveways
DATE: October 9, 2003; Thursday
TIME: 7:00a-9:00a/3:00p-5:00p
WEATHER: overcast in AM; sunny in PM
RECORDER: H. Funamura



TIME PERIOD	MOVEMENT NUMBER 1	2	3	4	5	6	7	8	9	10	11	12	TOTAL
7:00-7:15	2	7	2	0	4	8	5	3					31
7:15-7:30	4	7	0	2	4	10	3	2					32
7:30-7:45	12	20	4	8	14	11	4	6					79
7:45-8:00	9	19	3	8	8	12	5	3					67
8:00-8:15	3	4	2	2	13	11	0	5					40
8:15-8:30	6	4	0	3	5	9	0	3					30
8:30-8:45	7	5	4	2	7	13	1	5					44
8:45-9:00	5	2	2	5	5	13	3	5					40
7:00-9:00	48	68	17	30	60	87	21	32	0	0	0	0	363
7:15-8:15	25	32	9	15	33	45	6	16	0	0	0	0	181
3:00-3:15	9	2	4	8	5	21	11	10					70
3:15-3:30	9	8	3	4	10	17	6	12					69
3:30-3:45	4	6	2	13	8	18	15	17					83
3:45-4:00	7	2	4	1	7	21	11	12					65
4:00-4:15	8	3	5	7	0	20	8	10					61
4:15-4:30	3	4	3	3	5	14	5	10					47
4:30-4:45	7	9	9	12	7	9	15	23					91
4:45-5:00	6	1	1	4	4	11	11	14					52
3:00-5:00	53	35	31	52	46	131	82	108	0	0	0	0	538
4:00-5:00	24	17	18	26	16	54	39	57	0	0	0	0	251

TRAFFIC TURNING MOVEMENT COUNT
Lihue Civic Center Master Plan

LOCATION: Umi Street- State/County Driveway
DATE: December15, 2004; Wednesday
TIME: 7:00a-9:00a/3:00p-5:00p
WEATHER: overcast in AM; sunny in PM
RECORDER: H. Funamura



TIME PERIOD	MOVEMENT NUMBER 1	2	3	4	5	6	TOTAL
7:00-7:15	29	3	3	1	1	17	54
7:15-7:30	49	6	2	4	2	45	108
7:30-7:45	75	7	3	6	6	71	168
7:45-8:00	66	6	1	5	4	31	113
8:00-8:15	41	4	1	1	7	21	75
8:15-8:30	34	3	1	2	4	18	62
8:30-8:45	43	6	1	5	1	20	76
8:45-9:00	33	1	2	10	6	24	76
7:00-9:00	370	36	14	34	31	247	732
7:15-8:15	231	23	7	16	19	168	464
3:00-3:15	45	2	1	5	5	34	92
3:15-3:30	52	1	1	6	2	34	96
3:30-3:45	46	2	0	2	4	33	87
3:45-4:00	51	3	0	5	3	35	97
4:00-4:15	50	3	0	3	4	30	90
4:15-4:30	42	1	3	3	2	31	82
4:30-4:45	57	5	7	10	3	38	120
4:45-5:00	44	0	1	3	1	32	81
3:00-5:00	387	17	13	37	24	267	745
4:00-5:00	193	9	11	19	10	131	373

Appendix B

Signalized and Unsignalized Intersection
Level of Service (LOS) Calculations

RICE STREET/UMI STREET

CHAPTER 16 - OPERATIONAL ANALYSIS - SUMMARY WORKSHEET

General Information

Analyst: WY
Agency or Company:
Analysis Period/Year: 2003 AMEX
Comment: 2003 EXISTING AM PEAK HOUR

Site Information

Jurisdiction/Date: 10/28/03
EB/WB Street: RICE ST
NB/SB Street: UMI ST

Intersection Data

Area type: Other | Analysis period: .25 h | Signal type: Pretimed | % Back of queue: 70

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Volume (veh/h)	100	410	25	1	440	85	7	6	1	145	15	10
RTOR volume (veh/h)			0			0			0			0
Peak-hour factor	.85	.85	.85	.85	.85	.85	.85	.85	.85	.85	.85	.85
Heavy vehicles (%)	2	2	2	2	2	2	0	0	0	2	2	2
Start-up lost time, l_1 (s)	2	2	2	2	2	2	2	2	2	2	2	2
Extension of effective green, e (s)	2	2	2	2	2	2	2	2	2	2	2	2
Arrival type, AT	3	3	3	3	3	3	3	3	3	3	3	3
Approach pedestrian volume (p/h)	10			10			10			0		
Approach bicycle volume (bic/h)	0			0			0			0		
Left/right parking (Y or N)	N	/	N	N	/	N	N	/	N	N	/	N

Signal Phasing Plan

L: LT T: TH R: RT P: Peds

	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Phase 6	Phase 7	Phase 8
EB	LTRP							
WB	LTRP							
NB		LTRP						
SB		LTRP						
Green (s)	40	20						
Yellow + All red (s)	5	5						

Cycle (s): 70 | Lost time per cycle (s): 10 | Critical v/c Ratio: .445

Intersection Performance

	EB	WB	NB	SB	
Lane group configuration	LTR	LTR	LTR	LT	R
No. of lanes	2	2	1	1	1
Flow rate (veh/h)	629	619	16	188	12
Capacity (veh/h)	1481	1885	471	387	452
Adjusted saturation flow (veh/h)	2592	3298	1648	1355	1583
v/c ratio	.425	.328	.035	.486	.026
g/C ratio	.571	.571	.286	.486	.026
Average back of queue (veh)	4.2	3.8	.3	3.5	.2
Uniform delay (s)	8.5	7.9	18	20.7	18
Incremental delay (s)	.9	.5	.1	4.3	.1
Initial queue delay (s)	0	0	0	0	0
Delay (s)	9.4	8.4	18.1	25	18.1
LOS	A	A	B	C	B
Approach delay (s)/LOS	9.4 / A	8.4 / A	18.1 / B	24.6 / C	
Intersection delay (s)/ LOS	11.2 / B				

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CHAPTER 16 - OPERATIONAL ANALYSIS - SUMMARY WORKSHEET

General Information

Analyst: WY
Agency or Company: M&E
Analysis Period/Year: 2015 AMAMB1
Comment: 2015 AMBIENT AM FORECAST

Site Information

Jurisdiction/Date: 1/21/05
EB/WB Street: RICE ST
NB/SB Street: UMI ST

Intersection Data

Area type: Other | Analysis period: .25 h | Signal type: Pretimed | % Back of queue: 70

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Volume (veh/h)	120	490	30	1	515	100	10	5	1	165	20	10
RTOR volume (veh/h)			0			0			0			0
Peak-hour factor	.85	.85	.85	.85	.85	.85	.85	.85	.85	.85	.85	.85
Heavy vehicles (%)	2	2	2	2	2	2	0	0	0	2	2	2
Start-up lost time, l_1 (s)	2	2	2	2	2	2	2	2	2	2	2	2
Extension of effective green, e (s)	2	2	2	2	2	2	2	2	2	2	2	2
Arrival type, AT	3	3	3	3	3	3	3	3	3	3	3	3
Approach pedestrian volume (p/h)	10			10			10			0		
Approach bicycle volume (bic/h)	0			0			0			0		
Left/right parking (Y or N)	N	/	N	N	/	N	N	/	N	N	/	N

Signal Phasing Plan

L: LT T: TH R: RT P: Peds

	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Phase 6	Phase 7	Phase 8
EB	LTRP							
WB	LTRP							
NB		LTRP						
SB		LTRP						
Green (s)	40	20						
Yellow + All red (s)	5	5						

Cycle (s): 70 | Lost time per cycle (s): 10 | Critical v/c Ratio: .551

Intersection Performance

	EB	WB	NB	SB	
Lane group configuration	LTR	LTR	LTR	LT	R
No. of lanes	2	2	1	1	1
Flow rate (veh/h)	753	725	19	218	12
Capacity (veh/h)	1378	1884	447	388	452
Adjusted saturation flow (veh/h)	2411	3298	1565	1358	1583
v/c ratio	.546	.385	.042	.561	.026
g/C ratio	.571	.571	.286	.286	.286
Average back of queue (veh)	5.7	4.7	.3	4.2	.2
Uniform delay (s)	9.3	8.2	18.1	21.3	18
Incremental delay (s)	1.6	.6	.2	5.8	.1
Initial queue delay (s)	0	0	0	0	0
Delay (s)	10.9	8.8	18.3	27.1	18.1
LOS	B	A	B	C	B
Approach delay (s)/LOS	10.9 / B	8.8 / A	18.3 / B	26.6 / C	
Intersection delay (s)/ LOS	12.2 / B				

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CHAPTER 16 - OPERATIONAL ANALYSIS - SUMMARY WORKSHEET

General Information

Analyst: WY
Agency or Company: M&E
Analysis Period/Year: 2015 AMAMB2
Comment: 2015 AMBAMFC W/KUHIO/HARDY SIGNAL

Site Information

Jurisdiction/Date: 1/21/05
EB/WB Street: RICE ST
NB/SB Street: UMI ST

Intersection Data

Area type: Other | Analysis period: .25 h | Signal type: Pretimed | % Back of queue: 70

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Volume (veh/h)	120	430	30	1	515	100	10	5	1	195	20	10
RTOR volume (veh/h)			0			0			0			0
Peak-hour factor	.85	.85	.85	.85	.85	.85	.85	.85	.85	.85	.85	.85
Heavy vehicles (%)	2	2	2	2	2	2	0	0	0	2	2	2
Start-up lost time, l_1 (s)	2	2	2	2	2	2	2	2	2	2	2	2
Extension of effective green, e (s)	2	2	2	2	2	2	2	2	2	2	2	2
Arrival type, AT	3	3	3	3	3	3	3	3	3	3	3	3
Approach pedestrian volume (p/h)	10			10			10			0		
Approach bicycle volume (bic/h)	0			0			0			0		
Left/right parking (Y or N)	N	/	N	N	/	N	N	/	N	N	/	N

Signal Phasing Plan

L: LT T: TH R: RT P: Peds

	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Phase 6	Phase 7	Phase 8
EB	LTRP							
WB	LTRP							
NB		LTRP						
SB		LTRP						
Green (s)	40	20						
Yellow + All red (s)	5	5						

Cycle (s): 70 | Lost time per cycle (s): 10 | Critical v/c Ratio: .554

Intersection Performance

	EB		WB		NB		SB	
Lane group configuration	LTR		LTR		LTR		LT	R
No. of lanes	2		2		1		1	1
Flow rate (veh/h)	682		725		19		253	12
Capacity (veh/h)	1354		1885		442		386	452
Adjusted saturation flow (veh/h)	2370		3298		1547		1351	1583
v/c ratio	.504		.385		.043		.655	.026
g/C ratio	.571		.571		.286		.286	.286
Average back of queue (veh)	4.9		4.7		.3		5.2	.2
Uniform delay (s)	9		8.2		18.1		22	18
Incremental delay (s)	1.3		.6		.2		8.4	.1
Initial queue delay (s)	0		0		0		0	0
Delay (s)	10.3		8.8		18.3		30.4	18.1
LOS	B		A		B		C	B
Approach delay (s)/LOS	10.3 / B		8.8 / A		18.3 / B		29.8 / C	
Intersection delay (s)/ LOS	12.8 / B							

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CHAPTER 16 - OPERATIONAL ANALYSIS - SUMMARY WORKSHEET

General Information

Analyst: WY
Agency or Company: M&E
Analysis Period/Year: AM 20%RE 2PH 2015
Comment: 2015 REC 20% AMPKHR W/ 2 PHASE

Site Information

Jurisdiction/Date: 1/15/05
EB/WB Street: RICE ST
NB/SB Street: UMI ST

Intersection Data

Area type: Other | Analysis period: .25 h | Signal type: Pretimed | % Back of queue: 70

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Volume (veh/h)	285	470	30	1	435	190	7	6	1	195	20	85
RTOR volume (veh/h)			0			0			0			0
Peak-hour factor	.85	.85	.85	.85	.85	.85	.85	.85	.85	.85	.85	.85
Heavy vehicles (%)	2	2	2	2	2	2	0	0	0	2	2	2
Start-up lost time, l_1 (s)	2	2	2	2	2	2	2	2	2	2	2	2
Extension of effective green, e (s)	2	2	2	2	2	2	2	2	2	2	2	2
Arrival type, AT	3	3	3	3	3	3	3	3	3	3	3	3
Approach pedestrian volume (p/h)	10			10			10			0		
Approach bicycle volume (bic/h)	0			0			0			0		
Left/right parking (Y or N)	N	/	N	N	/	N	N	/	N	N	/	N

Signal Phasing Plan

L: LT T: TH R: RT P: Peds

	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Phase 6	Phase 7	Phase 8
EB	LTRP							
WB	LTRP							
NB		LTRP						
SB		LTRP						
Green (s)	40	20						
Yellow + All red (s)	5	5						

Cycle (s): 70 | Lost time per cycle (s): 10 | Critical v/c Ratio: .834

Intersection Performance

	EB		WB		NB		SB	
Lane group configuration	Def	TR	LTR		LTR		LT	R
No. of lanes	1	1	2		1		1	1
Flow rate (veh/h)	335	588	736		16		253	100
Capacity (veh/h)	364	1054	1842		463		385	452
Adjusted saturation flow (veh/h)	636	1845	3223		1619		1346	1583
v/c ratio	.922	.558	.4		.036		.658	.221
g/C ratio	.571	.571	.571		.286		.286	.286
Average back of queue (veh)	8.9	8.4	4.8		.3		5.2	1.6
Uniform delay (s)	13.6	9.4	8.3		18		22	19.1
Incremental delay (s)	31.1	2.1	.6		.1		8.5	1.1
Initial queue delay (s)	0	0	0		0		0	0
Delay (s)	44.7	11.5	8.9		18.1		30.5	20.2
LOS	D	B	A		B		C	C
Approach delay (s)/LOS	23.6 / C		8.9 / A		18.1 / B		27.6 / C	
Intersection delay (s)/ LOS	18.9 / B							

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CHAPTER 16 - OPERATIONAL ANALYSIS - SUMMARY WORKSHEET

General Information

Analyst: WY
Agency or Company: M&E
Analysis Period/Year: AMRE203PHLT 2015
Comment: 2015 RE 20% AMPKHRW/ 3 PHASE & LT

Site Information

Jurisdiction/Date: 1/16/05
EB/WB Street: RICE ST
NB/SB Street: UMI ST

Intersection Data

Area type: Other | Analysis period: .25 h | Signal type: Pretimed | % Back of queue: 70

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Volume (veh/h)	285	470	30	1	435	190	7	6	1	195	20	85
RTOR volume (veh/h)			0			0			0			0
Peak-hour factor	.85	.85	.85	.85	.85	.85	.85	.85	.85	.85	.85	.85
Heavy vehicles (%)	2	2	2	2	2	2	0	0	0	2	2	2
Start-up lost time, l_1 (s)	2	2	2	2	2	2	2	2	2	2	2	2
Extension of effective green, e (s)	2	2	2	2	2	2	2	2	2	2	2	2
Arrival type, AT	3	3	3	3	3	3	3	3	3	3	3	3
Approach pedestrian volume (p/h)	10			10			10			0		
Approach bicycle volume (bic/h)	0			0			0			0		
Left/right parking (Y or N)	N	/	N	N	/	N	N	/	N	N	/	N

Signal Phasing Plan

L: LT T: TH R: RT P: Peds

	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Phase 6	Phase 7	Phase 8
EB	LTRP	LTRP						
WB		LTRP						
NB			LTRP					
SB			LTRP					
Green (s)	5	35	20					
Yellow + All red (s)	5	5	5					

Cycle (s): 75 | Lost time per cycle (s): 10 | Critical v/c Ratio: .792

Intersection Performance

	EB			WB			NB			SB	
Lane group configuration	L	TR		LTR			LTR			LT	R
No. of lanes	1	1		2			1			1	1
Flow rate (veh/h)	335	588		736			16			253	100
Capacity (veh/h)	387	1107		1503			430			359	422
Adjusted saturation flow (veh/h)	1770	1845		3221			1614			1344	1583
v/c ratio	.867	.531		.49			.038			.705	.237
g/C ratio	.6	.6		.467			.267			.267	.267
Average back of queue (veh)	7.1	8.4		6.4			.3			5.8	1.8
Uniform delay (s)	11.7	8.8		13.8			20.4			24.8	21.5
Incremental delay (s)	22.2	1.8		1.1			.2			11.1	1.3
Initial queue delay (s)	0	0		0			0			0	0
Delay (s)	33.9	10.6		14.9			20.6			35.9	22.8
LOS	C	B		B			C			D	C
Approach delay (s)/LOS	19.1	/	B	14.9	/	B	20.6	/	C	32.2	/ C
Intersection delay (s)/ LOS	19.9		/			B					

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CHAPTER 16 - OPERATIONAL ANALYSIS - SUMMARY WORKSHEET

General Information

Analyst: WY
Agency or Company:
Analysis Period/Year: 2003 PMEX
Comment: 2003 EXISTING PM PEAK HOUR

Site Information

Jurisdiction/Date: 10/28/03
EB/WB Street: RICE ST
NB/SB Street: UMI ST

Intersection Data

Area type: Other | Analysis period: .25 h | Signal type: Pretimed | % Back of queue: 70

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Volume (veh/h)	75	480	30	8	555	55	55	20	4	150	20	135
RTOR volume (veh/h)			0			0			0			0
Peak-hour factor	.85	.85	.85	.85	.85	.85	.85	.85	.85	.85	.85	.85
Heavy vehicles (%)	2	2	2	2	2	2	0	0	0	2	2	2
Start-up lost time, l_1 (s)	2	2	2	2	2	2	2	2	2	2	2	2
Extension of effective green, e (s)	2	2	2	2	2	2	2	2	2	2	2	2
Arrival type, AT	3	3	3	3	3	3	3	3	3	3	3	3
Approach pedestrian volume (p/h)	10			10			10			0		
Approach bicycle volume (bic/h)	0			0			0			0		
Left/right parking (Y or N)	N	/	N	N	/	N	N	/	N	N	/	N

Signal Phasing Plan

L: LT T: TH R: RT P: Peds

	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Phase 6	Phase 7	Phase 8
EB	LTRP							
WB	LTRP							
NB		LTRP						
SB		LTRP						
Green (s)	40	20						
Yellow + All red (s)	5	5						

Cycle (s): 70 | Lost time per cycle (s): 10 | Critical v/c Ratio: .476

Intersection Performance

	EB			WB			NB			SB	
Lane group configuration		LTR			LTR			LTR		LT	R
No. of lanes		2			2			1		1	1
Flow rate (veh/h)		688			727			93		200	159
Capacity (veh/h)		1560			1891			342		366	452
Adjusted saturation flow (veh/h)		2730			3309			1195		1280	1583
v/c ratio		.441			.385			.272		.547	.351
g/C ratio		.571			.571			.286		.286	.286
Average back of queue (veh)		4.7			4.7			1.6		3.8	2.7
Uniform delay (s)		8.6			8.2			19.4		21.2	19.8
Incremental delay (s)		.9			.6			2		5.8	2.1
Initial queue delay (s)		0			0			0		0	0
Delay (s)		9.5			8.8			21.4		27	21.9
LOS		A			A			C		C	C
Approach delay (s)/LOS	9.5	/	A	8.8	/	A	21.4	/	C	24.7	/ C
Intersection delay (s)/ LOS	12.8		/			B					

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CHAPTER 16 - OPERATIONAL ANALYSIS - SUMMARY WORKSHEET

General Information

Analyst	WY	Jurisdiction/Date	1/21/05
Agency or Company	M&E	EB/WB Street	RICE ST
Analysis Period/Year	2015 PMAMB1	NB/SB Street	UMI ST
Comment	2015 AMBIENT PM FORECAST		

Site Information

Intersection Data

Area type: Other | Analysis period: .25 h | Signal type: Pretimed | % Back of queue: 70

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Volume (veh/h)	90	565	35	10	655	65	65	25	5	180	25	160
RTOR volume (veh/h)			0			0			0			0
Peak-hour factor	.85	.85	.85	.85	.85	.85	.85	.85	.85	.85	.85	.85
Heavy vehicles (%)	2	2	2	2	2	2	0	0	0	2	2	2
Start-up lost time, l_1 (s)	2	2	2	2	2	2	2	2	2	2	2	2
Extension of effective green, e (s)	2	2	2	2	2	2	2	2	2	2	2	2
Arrival type, AT	3	3	3	3	3	3	3	3	3	3	3	3
Approach pedestrian volume (p/h)	10			10			10			0		
Approach bicycle volume (bic/h)	0			0			0			0		
Left/right parking (Y or N)	N	/	N	N	/	N	N	/	N	N	/	N

Signal Phasing Plan

L: LT T: TH R: RT P: Peds

	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Phase 6	Phase 7	Phase 8
EB	LTRP							
WB	LTRP							
NB		LTRP						
SB		LTRP						
Green (s)	40	20						
Yellow + All red (s)	5	5						

Cycle (s): 70 | Lost time per cycle (s): 10 | Critical v/c Ratio: .59

Intersection Performance

	EB		WB		NB		SB	
Lane group configuration	LTR		LTR		LTR		LT	R
No. of lanes	2		2		1		1	1
Flow rate (veh/h)	812		859		112		241	188
Capacity (veh/h)	1460		1884		287		367	452
Adjusted saturation flow (veh/h)	2555		3296		1003		1285	1583
v/c ratio	.556		.456		.39		.657	.416
g/C ratio	.571		.571		.286		.286	.286
Average back of queue (veh)	6.2		5.9		2		5	3.4
Uniform delay (s)	9.4		8.7		20.1		22	20.3
Incremental delay (s)	1.5		.8		4		8.9	2.8
Initial queue delay (s)	0		0		0		0	0
Delay (s)	10.9		9.5		24.1		30.9	23.1
LOS	B		A		C		C	C
Approach delay (s)/LOS	10.9 / B		9.5 / A		24.1 / C		27.5 / C	
Intersection delay (s)/ LOS	14.2 / B							

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CHAPTER 16 - OPERATIONAL ANALYSIS - SUMMARY WORKSHEET

General Information

Analyst	WY	Jurisdiction/Date	1/21/05
Agency or Company	M&E	EB/WB Street	RICE ST
Analysis Period/Year	2015 PMAMB2	NB/SB Street	UMI ST
Comment	2015 AMBPMFC W/KUHIO-HARDY SIGNAL		

Site Information

Intersection Data

Area type: Other | Analysis period: .25 h | Signal type: Pretimed | % Back of queue: 70

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Volume (veh/h)	90	455	35	10	655	65	65	25	5	205	25	160
RTOR volume (veh/h)			0			0			0			0
Peak-hour factor	.85	.85	.85	.85	.85	.85	.85	.85	.85	.85	.85	.85
Heavy vehicles (%)	2	2	2	2	2	2	0	0	0	2	2	2
Start-up lost time, l_1 (s)	2	2	2	2	2	2	2	2	2	2	2	2
Extension of effective green, e (s)	2	2	2	2	2	2	2	2	2	2	2	2
Arrival type, AT	3	3	3	3	3	3	3	3	3	3	3	3
Approach pedestrian volume (p/h)	10			10			10			0		
Approach bicycle volume (bic/h)	0			0			0			0		
Left/right parking (Y or N)	N	/	N	N	/	N	N	/	N	N	/	N

Signal Phasing Plan

L: LT T: TH R: RT P: Peds

	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Phase 6	Phase 7	Phase 8
EB	LTRP							
WB	LTRP							
NB		LTRP						
SB		LTRP						
Green (s)	37	23						
Yellow + All red (s)	5	5						

Cycle (s): 70 | Lost time per cycle (s): 10 | Critical v/c Ratio: .577

Intersection Performance

	EB		WB		NB		SB	
Lane group configuration	LTR		LTR		LTR		LT	R
No. of lanes	2		2		1		1	1
Flow rate (veh/h)	682		859		112		271	188
Capacity (veh/h)	1284		1746		355		416	520
Adjusted saturation flow (veh/h)	2430		3303		1081		1265	1583
v/c ratio	.531		.492		.315		.651	.362
g/C ratio	.529		.529		.329		.329	.329
Average back of queue (veh)	5.4		6.4		1.8		5.4	3.1
Uniform delay (s)	10.8		10.5		17.6		20.1	17.9
Incremental delay (s)	1.6		1		2.3		7.7	1.9
Initial queue delay (s)	0		0		0		0	0
Delay (s)	12.4		11.5		19.9		27.8	19.8
LOS	B		B		B		C	B
Approach delay (s)/LOS	12.4 / B		11.5 / B		19.9 / B		24.5 / C	
Intersection delay (s)/ LOS	15.1 / B							

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CHAPTER 16 - OPERATIONAL ANALYSIS - SUMMARY WORKSHEET

General Information

Analyst: WY
Agency or Company: M&E
Analysis Period/Year: 2015 PMRB
Comment: 2015 REC PM PK HR W/ 2 PHASE

Site Information

Jurisdiction/Date: 1/16/05
EB/WB Street: RICE ST
NB/SB Street: UMI ST

Intersection Data

Area type: Other | Analysis period: .25 h | Signal type: Pretimed | % Back of queue: 70

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Volume (veh/h)	255	515	35	10	545	185	65	25	5	235	25	270
RTOR volume (veh/h)			0			0			0			0
Peak-hour factor	.85	.85	.85	.85	.85	.85	.85	.85	.85	.85	.85	.85
Heavy vehicles (%)	2	2	2	2	2	2	0	0	0	2	2	2
Start-up lost time, l_1 (s)	2	2	2	2	2	2	2	2	2	2	2	2
Extension of effective green, e (s)	2	2	2	2	2	2	2	2	2	2	2	2
Arrival type, AT	3	3	3	3	3	3	3	3	3	3	3	3
Approach pedestrian volume (p/h)	10			10			10			0		
Approach bicycle volume (bic/h)	0			0			0			0		
Left/right parking (Y or N)	N	/	N	N	/	N	N	/	N	N	/	N

Signal Phasing Plan

L: LT T: TH R: RT P: Peds

	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Phase 6	Phase 7	Phase 8
EB	LTRP							
WB	LTRP							
NB		LTRP						
SB		LTRP						
Green (s)	40	20						
Yellow + All red (s)	5	5						

Cycle (s): 70 | Lost time per cycle (s): 10 | Critical v/c Ratio: .945

Intersection Performance

	EB			WB			NB			SB	
Lane group configuration	Def	TR		LTR			LTR			LT	R
No. of lanes	1	1		2			1			1	1
Flow rate (veh/h)	300	647		871			112			306	318
Capacity (veh/h)	301	1054		1841			237			362	452
Adjusted saturation flow (veh/h)	527	1844		3222			829			1267	1583
v/c ratio	.995	.614		.473			.472			.845	.702
g/C ratio	.571	.571		.571			.286			.286	.286
Average back of queue (veh)	9.6	9.8		6			2.1			7.6	6.7
Uniform delay (s)	14.9	9.9		8.8			20.6			23.5	22.3
Incremental delay (s)	50.7	2.7		.9			6.6			20.9	8.8
Initial queue delay (s)	0	0		0			0			0	0
Delay (s)	65.6	12.6		9.7			27.2			44.4	31.1
LOS	E	B		A			C			D	C
Approach delay (s)/LOS	29.4	/	C	9.7	/	A	27.2	/	C	37.7	/ D
Intersection delay (s)/ LOS	24.6			/			C				

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CHAPTER 16 - OPERATIONAL ANALYSIS - SUMMARY WORKSHEET

General Information

Analyst: WY
Agency or Company: M&E
Analysis Period/Year: PMRE 3PHLT 2015
Comment: 2015 REC PMPKHR W/ 3 PH & EBLT LANE

Site Information

Jurisdiction/Date: 1/16/05
EB/WB Street: RICE ST
NB/SB Street: UMI ST

Intersection Data

Area type: Other | Analysis period: .25 h | Signal type: Pretimed | % Back of queue: 70

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Volume (veh/h)	255	515	35	10	545	185	65	25	5	235	25	270
RTOR volume (veh/h)			0			0			0			0
Peak-hour factor	.85	.85	.85	.85	.85	.85	.85	.85	.85	.85	.85	.85
Heavy vehicles (%)	2	2	2	2	2	2	0	0	0	2	2	2
Start-up lost time, l_1 (s)	2	2	2	2	2	2	2	2	2	2	2	2
Extension of effective green, e (s)	2	2	2	2	2	2	2	2	2	2	2	2
Arrival type, AT	3	3	3	3	3	3	3	3	3	3	3	3
Approach pedestrian volume (p/h)	10			10			10			0		
Approach bicycle volume (bic/h)	0			0			0			0		
Left/right parking (Y or N)	N	/	N	N	/	N	N	/	N	N	/	N

Signal Phasing Plan

L: LT T: TH R: RT P: Peds

	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Phase 6	Phase 7	Phase 8
EB	LTRP	LTRP						
WB		LTRP						
NB			LTRP					
SB			LTRP					
Green (s)	5	37	23					
Yellow + All red (s)	5	5	5					

Cycle (s): 80 | Lost time per cycle (s): 10 | Critical v/c Ratio: .891

Intersection Performance

	EB			WB			NB			SB	
Lane group configuration	L	TR		LTR			LTR			LT	R
No. of lanes	1	1		2			1			1	1
Flow rate (veh/h)	300	647		871			112			306	318
Capacity (veh/h)	318	1083		1488			237			368	455
Adjusted saturation flow (veh/h)	1770	1844		3218			826			1279	1583
v/c ratio	.942	.597		.585			.471			.832	.698
g/C ratio	.588	.588		.463			.288			.288	.288
Average back of queue (veh)	8.1	10.7		8.7			2.4			8.4	7.6
Uniform delay (s)	14.3	10.5		15.8			23.5			26.7	25.4
Incremental delay (s)	37.6	2.4		1.7			6.6			19.3	8.6
Initial queue delay (s)	0	0		0			0			0	0
Delay (s)	51.9	12.9		17.5			30.1			46	34
LOS	D	B		B			C			D	C
Approach delay (s)/LOS	25.2	/	C	17.5	/	B	30.1	/	C	39.9	/ D
Intersection delay (s)/ LOS	26.4			/			C				

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RICE STREET/EIWA STREET

CHAPTER 17 - TWSC - UNSIGNALIZED INTERSECTIONS WORKSHEET

Analysis Summary

General Information

Analyst	WY	Jurisdiction/Date	10/28/03
Agency or Company		Major Street	RICE ST
Analysis Period/Year	2003 AMEX	Minor Street	BIWA ST
Comment	2003 EXISTING AM PEAK HR		

Input Data

Lane Configuration	EB			WB			NB			SB		
Lane 1 (curb)	T			TR						R		
Lane 2	LT			T						L		
Lane 3												
	EB			WB			NB			SB		
Movement	1 (LT)	2 (TH)	3 (RT)	4 (LT)	5 (TH)	6 (RT)	7 (LT)	8 (TH)	9 (RT)	10 (LT)	11 (TH)	12 (RT)
Volume (veh/h)	175	495			540	75				30		170
PHF	.9	.9			.9	.9				.9		.9
Proportion of heavy vehicles, HV	3	3			3	3				3		3
Flow rate	194	550			600	83				33		189
Flare storage (# of vehs)												0
Median storage (# of vehs)										0		

Signal upstream of Movement 2 _____ ft Movement 5 _____ ft

Length of study period (h) .25

Output Data

	Lane	Movement	Flow Rate (veh/h)	Capacity (veh/h)	v/c	Queue Length (veh)	Control Delay (s)	LOS	Approach Delay and LOS
NB	1								
	2								
	3								
SB	1	R	189	651	.29	1	12.8	B	17.3
	2	L	30	118	.255	1	45.7	E	
	3								C
		①	194	899	.216	1	10.1	B	
		④							

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CHAPTER 17 - TWSC - UNSIGNALIZED INTERSECTIONS WORKSHEET

Analysis Summary

General Information

Analyst	WY	Jurisdiction/Date	1/21/05
Agency or Company		Major Street	RICE ST
Analysis Period/Year	AMAMB1 2015	Minor Street	BIWA ST
Comment	2015 AMBIENT AM PK HR		

Input Data

Lane Configuration	EB			WB			NB			SB		
Lane 1 (curb)	T			TR						R		
Lane 2	LT			T						L		
Lane 3												
	EB			WB			NB			SB		
Movement	1 (LT)	2 (TH)	3 (RT)	4 (LT)	5 (TH)	6 (RT)	7 (LT)	8 (TH)	9 (RT)	10 (LT)	11 (TH)	12 (RT)
Volume (veh/h)	190	590			645	75				35		200
PHF	.9	.9			.9	.9				.9		.9
Proportion of heavy vehicles, HV	3	3			3	3				3		3
Flow rate	211	656			717	83				39		222
Flare storage (# of vehs)												0
Median storage (# of vehs)										0		

Signal upstream of Movement 2 _____ ft Movement 5 _____ ft

Length of study period (h) .25

Output Data

	Lane	Movement	Flow Rate (veh/h)	Capacity (veh/h)	v/c	Queue Length (veh)	Control Delay (s)	LOS	Approach Delay and LOS
NB	1								
	2								
	3								
SB	1	R	222	597	.372	2	14.6	B	21.5
	2	L	30	82	.368	1	72.8	F	
	3								C
		①	211	812	.26	1	11	B	
		④							

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CHAPTER 17 - TWSC - UNSIGNALIZED INTERSECTIONS WORKSHEET

Analysis Summary

General Information

Analyst	WY	Jurisdiction/Date	1/21/05
Agency or Company		Major Street	RICE ST
Analysis Period/Year	AMAMB2 2015	Minor Street	EIWA ST
Comment	2015 AMB AMPKHRW/KUHIO-HARDY SIGNAL		

Site Information

Input Data

Lane Configuration	EB			WB			NB			SB		
Lane 1 (curb)		T			TR						R	
Lane 2		LT			T						L	
Lane 3												
	EB			WB			NB			SB		
Movement	1 (LT)	2 (TH)	3 (RT)	4 (LT)	5 (TH)	6 (RT)	7 (LT)	8 (TH)	9 (RT)	10 (LT)	11 (TH)	12 (RT)
Volume (veh/h)	190	530			645	75				35		75
PHF	.9	.9			.9	.9				.9		.9
Proportion of heavy vehicles, HV	3	3			3	3				3		3
Flow rate	211	589			717	83				39		83
Flare storage (# of vehs)												0
Median storage (# of vehs)										0		

Signal upstream of Movement 2 _____ ft Movement 5 _____ ft

Length of study period (h) .25

Output Data

	Lane	Movement	Flow Rate (veh/h)	Capacity (veh/h)	v/c	Queue Length (veh)	Control Delay (s)	LOS	Approach Delay and LOS
NB	1								
	2								
	3								
SB	1	R	83	597	.139	<1	12	B	26.8
	2	L	30	86	.349	1	67.9	F	
	3								D
		①	211	812	.26	1	11	B	
		④							

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CHAPTER 17 - TWSC - UNSIGNALIZED INTERSECTIONS WORKSHEET

Analysis Summary

General Information

Analyst	WY	Jurisdiction/Date	10/28/03
Agency or Company		Major Street	RICE ST
Analysis Period/Year	2003 PMEX	Minor Street	EIWA ST
Comment	2003 EXISTING PM PEAK HR		

Site Information

Input Data

Lane Configuration	EB			WB			NB			SB		
Lane 1 (curb)		T			TR						R	
Lane 2		LT			T						L	
Lane 3												
	EB			WB			NB			SB		
Movement	1 (LT)	2 (TH)	3 (RT)	4 (LT)	5 (TH)	6 (RT)	7 (LT)	8 (TH)	9 (RT)	10 (LT)	11 (TH)	12 (RT)
Volume (veh/h)	230	515			605	95				35		270
PHF	.9	.9			.9	.9				.9		.9
Proportion of heavy vehicles, HV	3	3			3	3				3		3
Flow rate	256	572			672	106				39		300
Flare storage (# of vehs)												0
Median storage (# of vehs)										0		

Signal upstream of Movement 2 _____ ft Movement 5 _____ ft

Length of study period (h) .25

Output Data

	Lane	Movement	Flow Rate (veh/h)	Capacity (veh/h)	v/c	Queue Length (veh)	Control Delay (s)	LOS	Approach Delay and LOS
NB	1								
	2								
	3								
SB	1	R	300	607	.494	3	16.6	C	24.3
	2	L	35	75	.469	2	90.1	F	
	3								C
		①	256	828	.309	1	11.3	B	
		④							

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CHAPTER 17 - TWSC - UNSIGNALIZED INTERSECTIONS WORKSHEET

Analysis Summary

General Information

Analyst	WY	Jurisdiction/Date	1/21/05
Agency or Company		Major Street	RICE ST
Analysis Period/Year	PMAMB1 2015	Minor Street	EIWA ST
Comment	2105 AMBIENT PM PK HR FORECAST		

Input Data

Lane Configuration	EB			WB			NB			SB		
Lane 1 (curb)		T			TR							R
Lane 2		LT			T							L
Lane 3												

	EB			WB			NB			SB		
Movement	1 (LT)	2 (TH)	3 (RT)	4 (LT)	5 (TH)	6 (RT)	7 (LT)	8 (TH)	9 (RT)	10 (LT)	11 (TH)	12 (RT)
Volume (veh/h)	265	615			720	105				30		310
PHF	.9	.9			.9	.9				.9		.9
Proportion of heavy vehicles, HV	3	3			3	3				3		3
Flow rate	294	683			800	117				33		344
Flare storage (# of vehs)												0
Median storage (# of vehs)										0		

Signal upstream of Movement 2 _____ ft Movement 5 _____ ft

Length of study period (h) .25

Output Data

	Lane	Movement	Flow Rate (veh/h)	Capacity (veh/h)	v/c	Queue Length (veh)	Control Delay (s)	LOS	Approach Delay and LOS
NB	1								
	2								
	3								
SB	1	R	344	547	.629	4	22.1	C	41.1
	2	L	35	43	.817	3	228.4	F	
	3								E
		①	294	734	.401	2	13.2	B	
		④							

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CHAPTER 17 - TWSC - UNSIGNALIZED INTERSECTIONS WORKSHEET

Analysis Summary

General Information

Analyst	WY	Jurisdiction/Date	1/21/05
Agency or Company		Major Street	RICE ST
Analysis Period/Year	PMAMB2 2015	Minor Street	EIWA ST
Comment	2105 AMBPMFC W/KUHIO-HARDY SIGNAL		

Input Data

Lane Configuration	EB			WB			NB			SB		
Lane 1 (curb)		T			TR							R
Lane 2		LT			T							L
Lane 3												

	EB			WB			NB			SB		
Movement	1 (LT)	2 (TH)	3 (RT)	4 (LT)	5 (TH)	6 (RT)	7 (LT)	8 (TH)	9 (RT)	10 (LT)	11 (TH)	12 (RT)
Volume (veh/h)	265	510			720	105				30		210
PHF	.9	.9			.9	.9				.9		.9
Proportion of heavy vehicles, HV	3	3			3	3				3		3
Flow rate	294	567			800	117				33		233
Flare storage (# of vehs)												0
Median storage (# of vehs)										0		

Signal upstream of Movement 2 _____ ft Movement 5 _____ ft

Length of study period (h) .25

Output Data

	Lane	Movement	Flow Rate (veh/h)	Capacity (veh/h)	v/c	Queue Length (veh)	Control Delay (s)	LOS	Approach Delay and LOS
NB	1								
	2								
	3								
SB	1	R	233	547	.426	2	16.4	C	39.7
	2	L	35	47	.746	3	195.1	F	
	3								E
		①	294	734	.401	2	13.2	B	
		④							

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RICE STREET/KELE STREET/COUNTY DRIVEWAY

CHAPTER 17 - TWSC - UNSIGNALIZED INTERSECTIONS WORKSHEET

Analysis Summary

General Information

Analyst	WY	Jurisdiction/Date	1/16/05
Agency or Company	M&E	Major Street	RICE ST
Analysis Period/Year	2003 AMEX	Minor Street	KELE ST
Comment	2003 EXISTING AM PK HR		

Site Information

Input Data

Lane Configuration	EB			WB			NB			SB		
Lane 1 (curb)		TR			T			LTR				
Lane 2		T			LT							
Lane 3												
	EB			WB			NB			SB		
Movement	1 (LT)	2 (TH)	3 (RT)	4 (LT)	5 (TH)	6 (RT)	7 (LT)	8 (TH)	9 (RT)	10 (LT)	11 (TH)	12 (RT)
Volume (veh/h)		710	40	35	630		15	0	30			
PHF		.9	.9	.9	.9		.9	.9	.9			
Proportion of heavy vehicles, HV		3	3	3	3		3	3	3			
Flow rate		789	44	39	700		17	0	33			
Flare storage (# of vehs)									0			
Median storage (# of vehs)							0					

Signal upstream of Movement 2 _____ ft Movement 5 _____ ft

Length of study period (h) .25

Output Data

	Lane	Movement	Flow Rate (veh/h)	Capacity (veh/h)	v/c	Queue Length (veh)	Control Delay (s)	LOS	Approach Delay and LOS
NB	1	LTR	50	259	.193	1	22.2	C	22.2
	2								
	3								C
SB	1		15						
	2								
	3								
		①							
		④	39	789	.049	<1	9.8	A	

CHAPTER 17 - TWSC - UNSIGNALIZED INTERSECTIONS WORKSHEET

Analysis Summary

General Information

Analyst	WY	Jurisdiction/Date	1/24/05
Agency or Company	M&E	Major Street	RICE ST
Analysis Period/Year	AM AMB1 2015	Minor Street	KELE ST
Comment	2015 AMBIENT AM FORECAST		

Site Information

Input Data

Lane Configuration	EB			WB			NB			SB		
Lane 1 (curb)		TR			T			LTR				
Lane 2		T			LT							
Lane 3												
	EB			WB			NB			SB		
Movement	1 (LT)	2 (TH)	3 (RT)	4 (LT)	5 (TH)	6 (RT)	7 (LT)	8 (TH)	9 (RT)	10 (LT)	11 (TH)	12 (RT)
Volume (veh/h)		820	40	35	750		15	0	30			
PHF		.9	.9	.9	.9		.9	.9	.9			
Proportion of heavy vehicles, HV		3	3	3	3		3	3	3			
Flow rate		911	44	39	833		17	0	33			
Flare storage (# of vehs)									0			
Median storage (# of vehs)							0					

Signal upstream of Movement 2 _____ ft Movement 5 _____ ft

Length of study period (h) .25

Output Data

	Lane	Movement	Flow Rate (veh/h)	Capacity (veh/h)	v/c	Queue Length (veh)	Control Delay (s)	LOS	Approach Delay and LOS
NB	1	LTR	50	198	.252	1	29.2	D	29.2
	2								
	3								D
SB	1		15						
	2								
	3								
		①							
		④	39	709	.055	<1	10.4	B	

CHAPTER 17 - TWSC - UNSIGNALIZED INTERSECTIONS WORKSHEET

Analysis Summary

General Information

Analyst	WY	Jurisdiction/Date	1/24/05
Agency or Company	M&E	Major Street	RICE ST
Analysis Period/Year	AM AMB2 2015	Minor Street	KELE ST
Comment	2015 AMBPMFC W/KUHIO-HARDY SIGNAL		

Site Information

Input Data

Lane Configuration	EB			WB			NB			SB		
Lane 1 (curb)	TR			T			LTR					
Lane 2	T			LT								
Lane 3												
	EB			WB			NB			SB		
Movement	1 (LT)	2 (TH)	3 (RT)	4 (LT)	5 (TH)	6 (RT)	7 (LT)	8 (TH)	9 (RT)	10 (LT)	11 (TH)	12 (RT)
Volume (veh/h)		760	40	35	635		15	0	30			
PHF		.9	.9	.9	.9		.9	.9	.9			
Proportion of heavy vehicles, HV		3	3	3	3		3	3	3			
Flow rate		844	44	39	706		17	0	33			
Flare storage (# of vehs)									0			
Median storage (# of vehs)							0					

Signal upstream of Movement 2 _____ ft Movement 5 _____ ft

Length of study period (h) .25

Output Data

	Lane	Movement	Flow Rate (veh/h)	Capacity (veh/h)	v/c	Queue Length (veh)	Control Delay (s)	LOS	Approach Delay and LOS
NB	1	LTR	50	238	.21	1	24.1	C	24.1
	2								
	3								C
SB	1		15						
	2								
	3								
		①							
		④	39	752	.052	<1	10.1	B	

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CHAPTER 17 - TWSC - UNSIGNALIZED INTERSECTIONS WORKSHEET

Analysis Summary

General Information

Analyst	WY	Jurisdiction/Date	1/15/05
Agency or Company	M&E	Major Street	RICE ST
Analysis Period/Year	2015 AM20RE	Minor Street	KELE ST/COUNTY DRIVEWAY
Comment	2015 RECMNDED 20% AM PK HR		

Site Information

Input Data

Lane Configuration	EB			WB			NB			SB		
Lane 1 (curb)	TR			TR			LTR			LTR		
Lane 2	LT			LT								
Lane 3												
	EB			WB			NB			SB		
Movement	1 (LT)	2 (TH)	3 (RT)	4 (LT)	5 (TH)	6 (RT)	7 (LT)	8 (TH)	9 (RT)	10 (LT)	11 (TH)	12 (RT)
Volume (veh/h)	20	820	40	35	635	15	25		20	5		10
PHF	.9	.9	.9	.9	.9	.9	.9	.9	.9	.9	.9	.9
Proportion of heavy vehicles, HV	3	3	3	3	3	3	3	3	3	3	3	3
Flow rate	22	911	44	39	706	17	28		22	6		11
Flare storage (# of vehs)									0			0
Median storage (# of vehs)							0			0		

Signal upstream of Movement 2 _____ ft Movement 5 _____ ft

Length of study period (h) .25

Output Data

	Lane	Movement	Flow Rate (veh/h)	Capacity (veh/h)	v/c	Queue Length (veh)	Control Delay (s)	LOS	Approach Delay and LOS
NB	1	LTR	45	141	.318	1	41.9	E	41.9
	2								
	3								E
SB	1	LTR	16	248	.065	<1	20.5	C	20.5
	2								
	3								C
		①	22	869	.026	<1	9.3	A	
		④	39	709	.055	<1	10.4	B	

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CHAPTER 17 - TWSC - UNSIGNALIZED INTERSECTIONS WORKSHEET

Analysis Summary

General Information

Analyst	WY	Jurisdiction/Date	1/15/05
Agency or Company	M&E	Major Street	RICE ST
Analysis Period/Year	AM20RE RT 2015	Minor Street	KELE ST/COUNTY DRIVEWAY
Comment	2015 RECMNDED 20%AM PK HR W/RT ONLY		

Input Data

Lane Configuration	EB	WB	NB	SB
Lane 1 (curb)	TR	TR	LTR	LTR
Lane 2	LT	LT		
Lane 3				

	EB			WB			NB			SB		
Movement	1 (LT)	2 (TH)	3 (RT)	4 (LT)	5 (TH)	6 (RT)	7 (LT)	8 (TH)	9 (RT)	10 (LT)	11 (TH)	12 (RT)
Volume (veh/h)	20	820	40	35	635	15	0		45	0		15
PHF	.9	.9	.9	.9	.9	.9	.9	.9	.9	.9	.9	.9
Proportion of heavy vehicles, HV	3	3	3	3	3	3	3	3	3	3	3	3
Flow rate	22	911	44	39	706	17	0		50	0		17
Flare storage (# of vehs)									0			0
Median storage (# of vehs)							0			0		

Signal upstream of Movement 2 _____ ft Movement 5 _____ ft

Length of study period (h) .25

Output Data

	Lane	Movement	Flow Rate (veh/h)	Capacity (veh/h)	v/c	Queue Length (veh)	Control Delay (s)	LOS	Approach Delay and LOS
NB	1	LTR	50	531	.094	<1	12.5	B	12.5
	2								
	3								B
SB	1	LTR	17	633	.027	<1	10.8	B	10.8
	2								
	3								B
		①	22	869	.026	<1	9.3	A	
		④	39	709	.055	<1	10.4	B	

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CHAPTER 16 - OPERATIONAL ANALYSIS - SUMMARY WORKSHEET

General Information

Analyst	WY	Jurisdiction/Date	1/16/05
Agency or Company	M&E	EB/WB Street	RICE ST
Analysis Period/Year	2015 20% AMRE	NB/SB Street	KELE ST/CO
Comment	2015 RECMNDED 20% AM PK HR		

Intersection Data

Area type Other Analysis period .25 h Signal type Actuated-Field % Back of queue 95

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Volume (veh/h)	20	820	40	35	635	15	25	0	20	5	0	10
RTOR volume (veh/h)			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
Start-up lost time, l_1 (s)	2	2	2	2	2	2	2	2	2	2	2	2
Extension of effective green, e (s)	2	2	2	2	2	2	2	2	2	2	2	2
Arrival type, AT	3	3	3	3	3	3	3	3	3	3	3	3
Approach pedestrian volume (p/h)	50			50			50			50		
Approach bicycle volume (bic/h)	0			0			0			0		
Left/right parking (Y or N)	N	/	N	N	/	N	N	/	N	N	/	N

Signal Phasing Plan

L: LT T: TH R: RT P: Peds

	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Phase 6	Phase 7	Phase 8
EB	LTRP							
WB	LTRP							
NB		LTRP						
SB		LTR						
Green (s)	50	20						
Yellow + All red (s)	5	5						

Cycle (s) 80 Lost time per cycle (s) 10 Critical v/c Ratio .375

Intersection Performance

	EB	WB	NB	SB
Lane group configuration	LTR	LTR	LTR	LTR
No. of lanes	2	2	1	1
Flow rate (veh/h)	957	745	49	16
Capacity (veh/h)	2036	1908	356	373
Adjusted saturation flow (veh/h)	3257	3054	1423	1491
v/c ratio	.47	.39	.137	.044
g/C ratio	.625	.625	.25	.25
Average back of queue (veh)	6.5	4.7	.9	.3
Uniform delay (s)	8	7.4	23.3	22.7
Incremental delay (s)	.1	0	0	0
Initial queue delay (s)	0	0	0	0
Delay (s)	8.1	7.4	23.3	22.7
LOS	A	A	C	C
Approach delay (s)/LOS	8.1 / A	7.4 / A	23.3 / C	22.7 / C
Intersection delay (s)/ LOS	8.4 / A			

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CHAPTER 17 - TWSC - UNSIGNALIZED INTERSECTIONS WORKSHEET

Analysis Summary

General Information

Analyst	WY	Jurisdiction/Date	1/16/05
Agency or Company	M&E	Major Street	RICE ST
Analysis Period/Year	2003 PMEX	Minor Street	KELE ST
Comment	2003 EXISTING PM PK HR		

Input Data

Lane Configuration	EB	WB	NB	SB
Lane 1 (curb)	TR	T	LTR	
Lane 2	T	LT		
Lane 3				

	EB			WB			NB			SB		
Movement	1 (LT)	2 (TH)	3 (RT)	4 (LT)	5 (TH)	6 (RT)	7 (LT)	8 (TH)	9 (RT)	10 (LT)	11 (TH)	12 (RT)
Volume (veh/h)		720	30	40	925		30		80			
PHF		.9	.9	.9	.9		.9	.9	.9			
Proportion of heavy vehicles, HV		3	3	3	3		3	3	3			
Flow rate		800	33	44	1028		33		89			
Flare storage (# of vehs)									0			
Median storage (# of vehs)							0					

Signal upstream of Movement 2 _____ ft Movement 5 _____ ft

Length of study period (h) .25

Output Data

	Lane	Movement	Flow Rate (veh/h)	Capacity (veh/h)	v/c	Queue Length (veh)	Control Delay (s)	LOS	Approach Delay and LOS
NB	1	LTR	149	182	.817	6	78.3	F	78.3
	2								
	3								F
SB	1		25						
	2								
	3								
		①							
		④	44	789	.056	<1	9.8	A	

CHAPTER 17 - TWSC - UNSIGNALIZED INTERSECTIONS WORKSHEET

Analysis Summary

General Information

Analyst	WY	Jurisdiction/Date	1/21/05
Agency or Company	M&E	Major Street	RICE ST
Analysis Period/Year	PM AMB1 2015	Minor Street	KELE ST
Comment	2015 AMBIENT PM PK HR FORECAST		

Input Data

Lane Configuration	EB	WB	NB	SB
Lane 1 (curb)	TR	T	LTR	
Lane 2	T	LT		
Lane 3				

	EB			WB			NB			SB		
Movement	1 (LT)	2 (TH)	3 (RT)	4 (LT)	5 (TH)	6 (RT)	7 (LT)	8 (TH)	9 (RT)	10 (LT)	11 (TH)	12 (RT)
Volume (veh/h)		850	30	40	1090		30		80			
PHF		.9	.9	.9	.9		.9	.9	.9			
Proportion of heavy vehicles, HV		3	3	3	3		3	3	3			
Flow rate		944	33	44	1211		33		89			
Flare storage (# of vehs)									0			
Median storage (# of vehs)							0					

Signal upstream of Movement 2 _____ ft Movement 5 _____ ft

Length of study period (h) .25

Output Data

	Lane	Movement	Flow Rate (veh/h)	Capacity (veh/h)	v/c	Queue Length (veh)	Control Delay (s)	LOS	Approach Delay and LOS
NB	1	LTR	149	126	1.185	9	205.5	F	205.5
	2								
	3								F
SB	1		25						
	2								
	3								
		①							
		④	44	695	.064	<1	10.5	B	

CHAPTER 17 - TWSC - UNSIGNALIZED INTERSECTIONS WORKSHEET

Analysis Summary

General Information

Analyst	WY	Jurisdiction/Date	1/21/05
Agency or Company	M&E	Major Street	RICE ST
Analysis Period/Year	PM AMB2 2015	Minor Street	KELB ST
Comment	2015 AMBPMFC W/KUHIO-HARDY SIGNAL		

Site Information

Input Data

Lane Configuration	EB			WB			NB			SB		
Lane 1 (curb)		TR			T			LTR				
Lane 2		T			LT							
Lane 3												
	EB			WB			NB			SB		
Movement	1 (LT)	2 (TH)	3 (RT)	4 (LT)	5 (TH)	6 (RT)	7 (LT)	8 (TH)	9 (RT)	10 (LT)	11 (TH)	12 (RT)
Volume (veh/h)		790	30	40	980		30		80			
PHF		.9	.9	.9	.9		.9	.9	.9			
Proportion of heavy vehicles, HV		3	3	3	3		3	3	3			
Flow rate		878	33	44	1089		33		89			
Flare storage (# of vehs)									0			
Median storage (# of vehs)							0					

Signal upstream of Movement 2 _____ ft Movement 5 _____ ft

Length of study period (h) .25

Output Data

	Lane	Movement	Flow Rate (veh/h)	Capacity (veh/h)	v/c	Queue Length (veh)	Control Delay (s)	LOS	Approach Delay and LOS
NB	1	LTR	149	154	.969	7	122.6	F	122.6
	2								
	3								F
SB	1		25						
	2								
	3								
		①							
		④	44	737	.06	<1	10.2	B	

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CHAPTER 17 - TWSC - UNSIGNALIZED INTERSECTIONS WORKSHEET

Analysis Summary

General Information

Analyst	WY	Jurisdiction/Date	1/11/05
Agency or Company	M&E	Major Street	RICE ST
Analysis Period/Year	2015 PMRE	Minor Street	KELE ST/COUNTY DRIVEWAY
Comment	2015 RECMNDED PM PK HR		

Site Information

Input Data

Lane Configuration	EB			WB			NB			SB		
Lane 1 (curb)		TR			TR			LTR			LTR	
Lane 2		LT			LT							
Lane 3												
	EB			WB			NB			SB		
Movement	1 (LT)	2 (TH)	3 (RT)	4 (LT)	5 (TH)	6 (RT)	7 (LT)	8 (TH)	9 (RT)	10 (LT)	11 (TH)	12 (RT)
Volume (veh/h)	10	695	30	40	885	6	60		50	5		20
PHF	.9	.9	.9	.9	.9	.9	.9	.9	.9	.9	.9	.9
Proportion of heavy vehicles, HV	3	3	3	3	3	3	3	3	3	3	3	3
Flow rate	11	772	33	44	983	7	67		56	6		22
Flare storage (# of vehs)									0			0
Median storage (# of vehs)							0			0		

Signal upstream of Movement 2 _____ ft Movement 5 _____ ft

Length of study period (h) .25

Output Data

	Lane	Movement	Flow Rate (veh/h)	Capacity (veh/h)	v/c	Queue Length (veh)	Control Delay (s)	LOS	Approach Delay and LOS
NB	1	LTR	110	148	.743	4	78.6	F	78.6
	2								
	3								F
SB	1	LTR	25	235	.107	<1	22.2	C	22.2
	2								
	3								C
		①	11	688	.016	<1	10.3	B	
		④	44	808	.055	<1	9.7	A	

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CHAPTER 17 - TWSC - UNSIGNALIZED INTERSECTIONS WORKSHEET

Analysis Summary

General Information

Analyst	WY	Jurisdiction/Date	1/15/05
Agency or Company	M&E	Major Street	RICE ST
Analysis Period/Year	2015 PMRE RT	Minor Street	KELE ST/COUNTY DRIVEWAY
Comment	2015 RECMNDED PM PK HR W/RT ONLY		

Input Data

Lane Configuration	EB	WB	NB	SB
Lane 1 (curb)	TR	TR	LTR	LTR
Lane 2	LT	LT		
Lane 3				

	EB			WB			NB			SB		
Movement	1 (LT)	2 (TH)	3 (RT)	4 (LT)	5 (TH)	6 (RT)	7 (LT)	8 (TH)	9 (RT)	10 (LT)	11 (TH)	12 (RT)
Volume (veh/h)	10	695	30	40	885	6	0		110	0		25
PHF	.9	.9	.9	.9	.9	.9	.9	.9	.9	.9	.9	.9
Proportion of heavy vehicles, HV	3	3	3	3	3	3	3	3	3	3	3	3
Flow rate	11	772	33	44	983	7	0		122	0		28
Flare storage (# of vehs)									0			0
Median storage (# of vehs)							0			0		

Signal upstream of Movement 2 _____ ft Movement 5 _____ ft

Length of study period (h) .25

Output Data

	Lane	Movement	Flow Rate (veh/h)	Capacity (veh/h)	v/c	Queue Length (veh)	Control Delay (s)	LOS	Approach Delay and LOS
NB	1	LTR	122	594	.205	1	12.6	B	12.6
	2								
	3								B
SB	1	LTR	28	517	.054	<1	12.4	B	12.4
	2								
	3								B
		①	11	688	.016	<1	10.3	B	
		④	44	808	.055	<1	9.7	A	

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CHAPTER 16 - OPERATIONAL ANALYSIS - SUMMARY WORKSHEET

General Information

Analyst	WY	Jurisdiction/Date	1/11/05
Agency or Company	M&E	EB/WB Street	RICE ST
Analysis Period/Year	2015 PMRE	NB/SB Street	KELE ST/CO
Comment	2015 RECMNDED PM PK HR		

Intersection Data

Area type Other Analysis period .25 h Signal type Actuated-Field % Back of queue 95

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Volume (veh/h)	10	695	30	40	885	6	60	0	50	5	0	20
RTOR volume (veh/h)			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
Start-up lost time, l_1 (s)	2	2	2	2	2	2	2	2	2	2	2	2
Extension of effective green, e (s)	2	2	2	2	2	2	2	2	2	2	2	2
Arrival type, AT	3	3	3	3	3	3	3	3	3	3	3	3
Approach pedestrian volume (p/h)	50			50			50			50		
Approach bicycle volume (bic/h)	0			0			0			0		
Left/right parking (Y or N)	N	/	N	N	/	N	N	/	N	N	/	N

Signal Phasing Plan

L: LT T: TH R: RT P: Peds

	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Phase 6	Phase 7	Phase 8
EB	LTRP							
WB	LTRP							
NB		LTRP						
SB		LTR						
Green (s)	50	20						
Yellow + All red (s)	5	5						

Cycle (s) 80 Lost time per cycle (s) 10 Critical v/c Ratio .47

Intersection Performance

	EB	WB	NB	SB
Lane group configuration	LTR	LTR	LTR	LTR
No. of lanes	2	2	1	1
Flow rate (veh/h)	799	1012	120	27
Capacity (veh/h)	2058	1957	340	371
Adjusted saturation flow (veh/h)	3293	3131	1359	1483
v/c ratio	.388	.517	.352	.073
g/C ratio	.625	.625	.25	.25
Average back of queue (veh)	5	7.2	2.4	.5
Uniform delay (s)	7.4	8.3	24.7	22.9
Incremental delay (s)	0	.2	0	0
Initial queue delay (s)	0	0	0	0
Delay (s)	7.4	8.5	24.7	22.9
LOS	A	A	C	C
Approach delay (s)/LOS	7.4 / A	8.5 / A	24.7 / C	22.9 / C
Intersection delay (s)/ LOS	9.3 / A			

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RICE STREET/COUNTY DRIVEWAY

CHAPTER 17 - TWSC - UNSIGNALIZED INTERSECTIONS WORKSHEET

Analysis Summary

General Information

Analyst	WY	Jurisdiction/Date	1/16/05
Agency or Company		Major Street	RICE ST
Analysis Period/Year	2003AMEX	Minor Street	DRIVEWAY TO SOUTH PARKING
Comment	2003 EXISTING AM PK HR		

Input Data

Lane Configuration	EB	WB	NB	SB
Lane 1 (curb)	T	TR		LR
Lane 2	LT	T		
Lane 3				

	EB			WB			NB			SB		
Movement	1 (LT)	2 (TH)	3 (RT)	4 (LT)	5 (TH)	6 (RT)	7 (LT)	8 (TH)	9 (RT)	10 (LT)	11 (TH)	12 (RT)
Volume (veh/h)	50	690			670	25				4		10
PHF	.9	.9			.9	.9				.9		.9
Proportion of heavy vehicles, HV	3	3			3	3				3		3
Flow rate	56	767			744	28				4		11
Flare storage (# of vehs)												0
Median storage (# of vehs)										0		

Signal upstream of Movement 2 _____ ft Movement 5 _____ ft

Length of study period (h) .25

Output Data

	Lane	Movement	Flow Rate (veh/h)	Capacity (veh/h)	v/c	Queue Length (veh)	Control Delay (s)	LOS	Approach Delay and LOS
NB	1								
	2								
	3								
SB	1	LR	11	609	.018	<1	11	B	11
	2								
	3								B
		①	56	832	.067	<1	9.6	A	
		④							

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CHAPTER 17 - TWSC - UNSIGNALIZED INTERSECTIONS WORKSHEET

Analysis Summary

General Information

Analyst	WY	Jurisdiction/Date	1/24/05
Agency or Company		Major Street	RICE ST
Analysis Period/Year	2015 AMAMB1	Minor Street	DRIVEWAY TO SOUTH PARKING
Comment	AMBIENT AM PK HR FORECAST		

Input Data

Lane Configuration	EB	WB	NB	SB
Lane 1 (curb)	T	TR		LR
Lane 2	LT	T		
Lane 3				

	EB			WB			NB			SB		
Movement	1 (LT)	2 (TH)	3 (RT)	4 (LT)	5 (TH)	6 (RT)	7 (LT)	8 (TH)	9 (RT)	10 (LT)	11 (TH)	12 (RT)
Volume (veh/h)	50	805			800	15				4		10
PHF	.9	.9			.9	.9				.9		.9
Proportion of heavy vehicles, HV	3	3			3	3				3		3
Flow rate	56	894			889	17				4		11
Flare storage (# of vehs)												0
Median storage (# of vehs)										0		

Signal upstream of Movement 2 _____ ft Movement 5 _____ ft

Length of study period (h) .25

Output Data

	Lane	Movement	Flow Rate (veh/h)	Capacity (veh/h)	v/c	Queue Length (veh)	Control Delay (s)	LOS	Approach Delay and LOS
NB	1								
	2								
	3								
SB	1	LR	11	551	.02	<1	11.7	B	11.7
	2								
	3								B
		①	56	741	.075	<1	10.3	B	
		④							

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CHAPTER 17 - TWSC - UNSIGNALIZED INTERSECTIONS WORKSHEET

Analysis Summary

General Information

Analyst	WY	Jurisdiction/Date	1/24/05
Agency or Company		Major Street	RICE ST
Analysis Period/Year	2015 AMAMB2	Minor Street	DRIVEWAY TO SOUTH PARKING
Comment	2015 AMB AM FC W/KUHIO-HARDY SIGNAL		

Input Data

Lane Configuration	EB			WB			NB			SB		
Lane 1 (curb)	T			TR						LR		
Lane 2	LT			T								
Lane 3												
	EB			WB			NB			SB		
Movement	1 (LT)	2 (TH)	3 (RT)	4 (LT)	5 (TH)	6 (RT)	7 (LT)	8 (TH)	9 (RT)	10 (LT)	11 (TH)	12 (RT)
Volume (veh/h)	50	805			685	15				4		10
PHF	.9	.9			.9	.9				.9		.9
Proportion of heavy vehicles, HV	3	3			3	3				3		3
Flow rate	56	894			761	17				4		11
Flare storage (# of vehs)												0
Median storage (# of vehs)										0		

Signal upstream of Movement 2 _____ ft Movement 5 _____ ft

Length of study period (h) .25

Output Data

	Lane	Movement	Flow Rate (veh/h)	Capacity (veh/h)	v/c	Queue Length (veh)	Control Delay (s)	LOS	Approach Delay and LOS
NB	1								
	2								
	3								
SB	1	LR	11	607	.018	<1	11	B	11
	2								
	3								B
		①	56	828	.067	<1	9.7	A	
		④							

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CHAPTER 17 - TWSC - UNSIGNALIZED INTERSECTIONS WORKSHEET

Analysis Summary

General Information

Analyst	WY	Jurisdiction/Date	2/23/04
Agency or Company		Major Street	RICE ST
Analysis Period/Year	2003EXPM	Minor Street	DRIVEWAY TO SOUTH PARKING
Comment	EXISTING 2003 PM AT SOUTH DRIVEWAY		

Input Data

Lane Configuration	EB			WB			NB			SB		
Lane 1 (curb)	T			TR						LR		
Lane 2	LT			T								
Lane 3												
	EB			WB			NB			SB		
Movement	1 (LT)	2 (TH)	3 (RT)	4 (LT)	5 (TH)	6 (RT)	7 (LT)	8 (TH)	9 (RT)	10 (LT)	11 (TH)	12 (RT)
Volume (veh/h)	25	675			870	10				4		65
PHF	.9	.9			.9	.9				.9		.9
Proportion of heavy vehicles, HV	3	3			3	3				3		3
Flow rate	28	750			967	11				4		72
Flare storage (# of vehs)												0
Median storage (# of vehs)										0		

Signal upstream of Movement 2 _____ ft Movement 5 _____ ft

Length of study period (h) .25

Output Data

	Lane	Movement	Flow Rate (veh/h)	Capacity (veh/h)	v/c	Queue Length (veh)	Control Delay (s)	LOS	Approach Delay and LOS
NB	1								
	2								
	3								
SB	1	LR	72	522	.138	<1	13	B	13
	2								
	3								B
		①	28	695	.04	<1	10.4	B	
		④							

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CHAPTER 17 - TWSC - UNSIGNALIZED INTERSECTIONS WORKSHEET

Analysis Summary

General Information

Analyst	WY	Jurisdiction/Date	1/24/05
Agency or Company		Major Street	RICE ST
Analysis Period/Year	2015 PM AMB1	Minor Street	DRIVEWAY TO SOUTH PARKING
Comment	2015 AMBIENT PM PK HR FORECAST		

Input Data

Lane Configuration	EB			WB			NB			SB		
Lane 1 (curb)		T			TR							LR
Lane 2		LT			T							
Lane 3												
	EB			WB			NB			SB		
Movement	1 (LT)	2 (TH)	3 (RT)	4 (LT)	5 (TH)	6 (RT)	7 (LT)	8 (TH)	9 (RT)	10 (LT)	11 (TH)	12 (RT)
Volume (veh/h)	25	795			1025	10				4		65
PHF	.9	.9			.9	.9				.9		.9
Proportion of heavy vehicles, HV	3	3			3	3				3		3
Flow rate	28	883			1139	11				4		72
Flare storage (# of vehs)												0
Median storage (# of vehs)										0		

Signal upstream of Movement 2 _____ ft Movement 5 _____ ft

Length of study period (h) .25

Output Data

	Lane	Movement	Flow Rate (veh/h)	Capacity (veh/h)	v/c	Queue Length (veh)	Control Delay (s)	LOS	Approach Delay and LOS
NB	1								
	2								
	3								
SB	1	LR	72	459	.157	1	14.3	B	14.3
	2								
	3								B
		①	28	598	.046	<1	11.3	B	
		④							

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CHAPTER 17 - TWSC - UNSIGNALIZED INTERSECTIONS WORKSHEET

Analysis Summary

General Information

Analyst	WY	Jurisdiction/Date	1/24/05
Agency or Company		Major Street	RICE ST
Analysis Period/Year	2015 PM AMB2	Minor Street	DRIVEWAY TO SOUTH PARKING
Comment	2015 AMBPMFC W/KUHIO-HARDY SIGNAL		

Input Data

Lane Configuration	EB			WB			NB			SB		
Lane 1 (curb)		T			TR							LR
Lane 2		LT			T							
Lane 3												
	EB			WB			NB			SB		
Movement	1 (LT)	2 (TH)	3 (RT)	4 (LT)	5 (TH)	6 (RT)	7 (LT)	8 (TH)	9 (RT)	10 (LT)	11 (TH)	12 (RT)
Volume (veh/h)	25	735			920	10				4		65
PHF	.9	.9			.9	.9				.9		.9
Proportion of heavy vehicles, HV	3	3			3	3				3		3
Flow rate	28	817			1022	11				4		72
Flare storage (# of vehs)												0
Median storage (# of vehs)										0		

Signal upstream of Movement 2 _____ ft Movement 5 _____ ft

Length of study period (h) .25

Output Data

	Lane	Movement	Flow Rate (veh/h)	Capacity (veh/h)	v/c	Queue Length (veh)	Control Delay (s)	LOS	Approach Delay and LOS
NB	1								
	2								
	3								
SB	1	LR	72	501	.144	<1	13.4	B	13.4
	2								
	3								B
		①	28	662	.042	<1	10.7	B	
		④							

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RICE STREET/HALEKO ROAD

CHAPTER 17 - TWSC - UNSIGNALIZED INTERSECTIONS WORKSHEET

Analysis Summary

General Information

Analyst	WY	Jurisdiction/Date	10/28/03
Agency or Company		Major Street	RICE ST
Analysis Period/Year	2003 AMEX	Minor Street	HALEKO ST
Comment	2003 EXISTING AM PEAK HR		

Input Data

Lane Configuration	EB			WB			NB			SB		
Lane 1 (curb)		TR			T			R				
Lane 2					LT							
Lane 3												
	EB			WB			NB			SB		
Movement	1 (LT)	2 (TH)	3 (RT)	4 (LT)	5 (TH)	6 (RT)	7 (LT)	8 (TH)	9 (RT)	10 (LT)	11 (TH)	12 (RT)
Volume (veh/h)		380	95	340	280				410			
PHF		.9	.9	.9	.9				.9			
Proportion of heavy vehicles, HV		3	3	3	3				3			
Flow rate		422	106	378	311				456			
Flare storage (# of vehs)												
Median storage (# of vehs)									0			

Signal upstream of Movement 2 _____ ft Movement 5 _____ ft

Length of study period (h) .25

Output Data

	Lane	Movement	Flow Rate (veh/h)	Capacity (veh/h)	v/c	Queue Length (veh)	Control Delay (s)	LOS	Approach Delay and LOS
NB	1	R	456	533	.855	9	39.6	E	39.6
	2								
	3								E
SB	1								
	2								
	3								
		①							
		④	378	1028	.367	2	10.5	B	

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CHAPTER 17 - TWSC - UNSIGNALIZED INTERSECTIONS WORKSHEET

Analysis Summary

General Information

Analyst	WY	Jurisdiction/Date	1/21/05
Agency or Company	M&E	Major Street	RICE ST
Analysis Period/Year	AM AMB1 2015	Minor Street	HALEKO ST
Comment	2015 AMBIENT AM PK HR FORECAST		

Input Data

Lane Configuration	EB			WB			NB			SB		
Lane 1 (curb)		TR			T			R				
Lane 2					LT							
Lane 3												
	EB			WB			NB			SB		
Movement	1 (LT)	2 (TH)	3 (RT)	4 (LT)	5 (TH)	6 (RT)	7 (LT)	8 (TH)	9 (RT)	10 (LT)	11 (TH)	12 (RT)
Volume (veh/h)		445	115	405	330				475			
PHF		.9	.9	.9	.9				.9			
Proportion of heavy vehicles, HV		3	3	3	3				3			
Flow rate		494	128	450	367				528			
Flare storage (# of vehs)									0			
Median storage (# of vehs)												

Signal upstream of Movement 2 _____ ft Movement 5 _____ ft

Length of study period (h) .25

Output Data

	Lane	Movement	Flow Rate (veh/h)	Capacity (veh/h)	v/c	Queue Length (veh)	Control Delay (s)	LOS	Approach Delay and LOS
NB	1	R	528	470	1.123	18	108.3	F	108.3
	2								
	3								F
SB	1								
	2								
	3								
		①							
		④	450	948	.475	3	12.2	B	

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CHAPTER 17 - TWSC - UNSIGNALIZED INTERSECTIONS WORKSHEET

Analysis Summary

General Information

Analyst	WY	Jurisdiction/Date	1/21/05
Agency or Company	M&E	Major Street	RICE ST
Analysis Period/Year	AM AMB2 2015	Minor Street	HALEKO ST
Comment	2015 AMBAMFC W/KUHIO-HARDY SIGNAL		

Site Information

Input Data

Lane Configuration	EB	WB	NB	SB
Lane 1 (curb)	TR	T	R	
Lane 2		LT		
Lane 3				

	EB			WB			NB			SB		
Movement	1 (LT)	2 (TH)	3 (RT)	4 (LT)	5 (TH)	6 (RT)	7 (LT)	8 (TH)	9 (RT)	10 (LT)	11 (TH)	12 (RT)
Volume (veh/h)		385	115	405	230				475			
PHF		.9	.9	.9	.9				.9			
Proportion of heavy vehicles, HV		3	3	3	3				3			
Flow rate		428	128	450	256				528			
Flare storage (# of vehs)												
Median storage (# of vehs)									0			

Signal upstream of Movement 2 _____ ft Movement 5 _____ ft

Length of study period (h) .25

Output Data

	Lane	Movement	Flow Rate (veh/h)	Capacity (veh/h)	v/c	Queue Length (veh)	Control Delay (s)	LOS	Approach Delay and LOS
NB	1	R	528	520	1.015	15	71.7	F	71.7
	2								
	3								F
SB	1								
	2								
	3								
		①							
		④	450	1004	.448	2	11.5	B	

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CHAPTER 17 - TWSC - UNSIGNALIZED INTERSECTIONS WORKSHEET

Analysis Summary

General Information

Analyst	WY	Jurisdiction/Date	1/16/05
Agency or Company	M&E	Major Street	RICE ST
Analysis Period/Year	AM20%RE 2015	Minor Street	HALEKO ST
Comment	2015 RCMNDED 20% AM PEAK HR		

Site Information

Input Data

Lane Configuration	EB	WB	NB	SB
Lane 1 (curb)	TR	T	R	
Lane 2		LT		
Lane 3				

	EB			WB			NB			SB		
Movement	1 (LT)	2 (TH)	3 (RT)	4 (LT)	5 (TH)	6 (RT)	7 (LT)	8 (TH)	9 (RT)	10 (LT)	11 (TH)	12 (RT)
Volume (veh/h)		385	135	355	285				485			
PHF		.9	.9	.9	.9				.9			
Proportion of heavy vehicles, HV		3	3	3	3				3			
Flow rate		428	150	394	317				539			
Flare storage (# of vehs)									0			
Median storage (# of vehs)												

Signal upstream of Movement 2 _____ ft Movement 5 _____ ft

Length of study period (h) .25

Output Data

	Lane	Movement	Flow Rate (veh/h)	Capacity (veh/h)	v/c	Queue Length (veh)	Control Delay (s)	LOS	Approach Delay and LOS
NB	1	R	539	511	1.054	16	83.2	F	83.2
	2								
	3								F
SB	1								
	2								
	3								
		①							
		④	394	985	.4	2	11.1	B	

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CHAPTER 17 - TWSC - UNSIGNALIZED INTERSECTIONS WORKSHEET

Analysis Summary

General Information

Analyst	WY	Jurisdiction/Date	1/15/05
Agency or Company	M&E	Major Street	RICE ST
Analysis Period/Year	AMRE 2EB 20% 2015	Minor Street	HALEKO ST
Comment	2015 RCMDED 20%AM PK HR W/2EB LANE		

Input Data

Lane Configuration	EB			WB			NB			SB		
Lane 1 (curb)		R			T			R				
Lane 2		T			LT							
Lane 3												

	EB			WB			NB			SB		
Movement	1 (LT)	2 (TH)	3 (RT)	4 (LT)	5 (TH)	6 (RT)	7 (LT)	8 (TH)	9 (RT)	10 (LT)	11 (TH)	12 (RT)
Volume (veh/h)		385	135	355	285				485			
PHF		.9	.9	.9	.9				.9			
Proportion of heavy vehicles, HV		3	3	3	3				3			
Flow rate		428	150	394	317				539			
Flare storage (# of vehs)												
Median storage (# of vehs)									0			

Signal upstream of Movement 2 _____ ft Movement 5 _____ ft

Length of study period (h) .25

Output Data

	Lane	Movement	Flow Rate (veh/h)	Capacity (veh/h)	v/c	Queue Length (veh)	Control Delay (s)	LOS	Approach Delay and LOS
NB	1	R	539	572	.941	12	51.4	F	51.4
	2								
	3								F
SB	1								
	2								
	3								
		①							
		④	394	985	.4	2	11.1	B	

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CHAPTER 16 - OPERATIONAL ANALYSIS - SUMMARY WORKSHEET

General Information

Analyst	WY	Jurisdiction/Date	1/16/05
Agency or Company	M&E	EB/WB Street	RICE ST
Analysis Period/Year	2015 20% AMRE	NB/SB Street	HALEKO ST
Comment	2015 REC 20% AM PK HR		

Intersection Data

Area type Other Analysis period .25 h Signal type Actuated-Field % Back of queue 95

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Volume (veh/h)		385	135	355	285				485			
RTOR volume (veh/h)			0			0			40			
Peak-hour factor		.92	.92	.92	.92				.92			
Heavy vehicles (%)		2	2	2	2				2			
Start-up lost time, l_1 (s)		2	2	2	2				2			
Extension of effective green, e (s)		2	2	2	2				2			
Arrival type, AT		3	3	3	3				3			
Approach pedestrian volume (p/h)		50			0			50				
Approach bicycle volume (bic/h)		0			0			0				
Left/right parking (Y or N)	N	/	N	N	/	N	N	/	N		/	

Signal Phasing Plan

L: LT T: TH R: RT P: Peds

	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Phase 6	Phase 7	Phase 8
EB		TRP						
WB	LT	LT						
NB			R					
SB								
Green (s)	8	30	27					
Yellow + All red (s)	5	5	5					

Cycle (s) 80 Lost time per cycle (s) 15 Critical v/c Ratio .886

Intersection Performance

	EB			WB			NB			SB		
Lane group configuration		TR		Def	T				R			
No. of lanes		1		1	1				1			
Flow rate (veh/h)		565		386	310				440			
Capacity (veh/h)		669		809	993				491			
Adjusted saturation flow (veh/h)		1783		1770	1848				1455			
v/c ratio		.845		.477	.312				.897			
g/C ratio		.375		.538	.538				.338			
Average back of queue (veh)		13.8		5.5	4.1				11.9			
Uniform delay (s)		22.9		16.3	10.3				25.2			
Incremental delay (s)		9.8		.4	0				19			
Initial queue delay (s)		0		0	0				0			
Delay (s)		32.7		16.7	10.3				44.2			
LOS		C		B	B				D			
Approach delay (s)/LOS	32.7 / C			13.8 / B			44.2 / D			/		
Intersection delay (s)/ LOS	27.9 / C											

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CHAPTER 17 - TWSC - UNSIGNALIZED INTERSECTIONS WORKSHEET

Analysis Summary

General Information

Analyst	WY	Jurisdiction/Date	10/28/03
Agency or Company		Major Street	RICE ST
Analysis Period/Year	2003 PMEX	Minor Street	HALEKO ST
Comment	2003 EXISTING PM PEAK HR		

Input Data

Lane Configuration	EB			WB			NB			SB		
Lane 1 (curb)		TR			T			R				
Lane 2					LT							
Lane 3												
	EB			WB			NB			SB		
Movement	1 (LT)	2 (TH)	3 (RT)	4 (LT)	5 (TH)	6 (RT)	7 (LT)	8 (TH)	9 (RT)	10 (LT)	11 (TH)	12 (RT)
Volume (veh/h)		330	230	545	385				390			
PHF		.9	.9	.9	.9				.9			
Proportion of heavy vehicles, HV		3	3	3	3				3			
Flow rate		367	256	606	428				433			
Flare storage (# of vehs)												
Median storage (# of vehs)									0			

Signal upstream of Movement 2 _____ ft Movement 5 _____ ft

Length of study period (h) .25

Output Data

	Lane	Movement	Flow Rate (veh/h)	Capacity (veh/h)	v/c	Queue Length (veh)	Control Delay (s)	LOS	Approach Delay and LOS
NB	1	R	433	518	.836	8	38.1	E	38.1
	2								E
	3								
SB	1								
	2								
	3								
		①							
		④	606	948	.639	5	15.3	C	

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CHAPTER 17 - TWSC - UNSIGNALIZED INTERSECTIONS WORKSHEET

Analysis Summary

General Information

Analyst	WY	Jurisdiction/Date	1/21/05
Agency or Company	M&E	Major Street	RICE ST
Analysis Period/Year	PM AMB1 2015	Minor Street	HALEKO ST
Comment	2015 AMBIENT PM PK HR FORECAST		

Input Data

Lane Configuration	EB			WB			NB			SB		
Lane 1 (curb)		TR			T			R				
Lane 2					LT							
Lane 3												
	EB			WB			NB			SB		
Movement	1 (LT)	2 (TH)	3 (RT)	4 (LT)	5 (TH)	6 (RT)	7 (LT)	8 (TH)	9 (RT)	10 (LT)	11 (TH)	12 (RT)
Volume (veh/h)		385	275	635	450				460			
PHF		.9	.9	.9	.9				.9			
Proportion of heavy vehicles, HV		3	3	3	3				3			
Flow rate		428	306	706	500				511			
Flare storage (# of vehs)												
Median storage (# of vehs)									0			

Signal upstream of Movement 2 _____ ft Movement 5 _____ ft

Length of study period (h) .25

Output Data

	Lane	Movement	Flow Rate (veh/h)	Capacity (veh/h)	v/c	Queue Length (veh)	Control Delay (s)	LOS	Approach Delay and LOS
NB	1	R	511	455	1.124	18	109.8	F	109.8
	2								F
	3								
SB	1								
	2								
	3								
		①							
		④	706	861	.82	9	25.1	D	

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CHAPTER 17 - TWSC - UNSIGNALIZED INTERSECTIONS WORKSHEET

Analysis Summary

General Information

Analyst	WY	Jurisdiction/Date	1/21/05
Agency or Company	M&E	Major Street	RICE ST
Analysis Period/Year	PM AMB2 2015	Minor Street	HALEKO ST
Comment	2015 AMBPMFC W/KUHIO-HARDY SIGNAL		

Input Data

Lane Configuration	EB			WB			NB			SB		
Lane 1 (curb)		TR			T			R				
Lane 2					LT							
Lane 3												
	EB			WB			NB			SB		
Movement	1 (LT)	2 (TH)	3 (RT)	4 (LT)	5 (TH)	6 (RT)	7 (LT)	8 (TH)	9 (RT)	10 (LT)	11 (TH)	12 (RT)
Volume (veh/h)		325	275	635	340				460			
PHF		.9	.9	.9	.9				.9			
Proportion of heavy vehicles, HV		3	3	3	3				3			
Flow rate		361	306	706	378				511			
Flare storage (# of vehs)									0			
Median storage (# of vehs)												

Signal upstream of Movement 2 _____ ft Movement 5 _____ ft

Length of study period (h) .25

Output Data

	Lane	Movement	Flow Rate (veh/h)	Capacity (veh/h)	v/c	Queue Length (veh)	Control Delay (s)	LOS	Approach Delay and LOS
NB	1	R	511	503	1.016	14	73.1	F	73.1
	2								
	3								F
SB	1								
	2								
	3								
		①							
		④	706	912	.774	8	21	C	

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CHAPTER 17 - TWSC - UNSIGNALIZED INTERSECTIONS WORKSHEET

Analysis Summary

General Information

Analyst	WY	Jurisdiction/Date	1/10/05
Agency or Company		Major Street	RICE ST
Analysis Period/Year	2015 PMRE	Minor Street	HALEKO ST
Comment	2015 RECMNDED PM PEAK HR		

Input Data

Lane Configuration	EB			WB			NB			SB		
Lane 1 (curb)		TR			T			R				
Lane 2					LT							
Lane 3												
	EB			WB			NB			SB		
Movement	1 (LT)	2 (TH)	3 (RT)	4 (LT)	5 (TH)	6 (RT)	7 (LT)	8 (TH)	9 (RT)	10 (LT)	11 (TH)	12 (RT)
Volume (veh/h)		260	390	555	335				470			
PHF		.9	.9	.9	.9				.9			
Proportion of heavy vehicles, HV		3	3	3	3				3			
Flow rate		289	433	617	372				522			
Flare storage (# of vehs)									0			
Median storage (# of vehs)												

Signal upstream of Movement 2 _____ ft Movement 5 _____ ft

Length of study period (h) .25

Output Data

	Lane	Movement	Flow Rate (veh/h)	Capacity (veh/h)	v/c	Queue Length (veh)	Control Delay (s)	LOS	Approach Delay and LOS
NB	1	R	522	509	1.025	15	75.1	F	75.1
	2								
	3								F
SB	1								
	2								
	3								
		①							
		④	617	869	.71	6	18.6	C	

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CHAPTER 17 - TWSC - UNSIGNALIZED INTERSECTIONS WORKSHEET

Analysis Summary

General Information

Analyst	WY	Jurisdiction/Date	1/15/05
Agency or Company		Major Street	RICE ST
Analysis Period/Year	2015 PMRE 2EB	Minor Street	HALEKO ST
Comment	2015 RECMNDED PM PEAK HR W/2EB LAN		

Input Data

Lane Configuration	EB			WB			NB			SB		
Lane 1 (curb)		R			T			R				
Lane 2		T			LT							
Lane 3												

Movement	EB			WB			NB			SB		
	1 (LT)	2 (TH)	3 (RT)	4 (LT)	5 (TH)	6 (RT)	7 (LT)	8 (TH)	9 (RT)	10 (LT)	11 (TH)	12 (RT)
Volume (veh/h)		260	390	555	335				470			
PHF		.9	.9	.9	.9				.9			
Proportion of heavy vehicles, HV		3	3	3	3				3			
Flow rate		289	433	617	372				522			
Flare storage (# of vehs)									0			
Median storage (# of vehs)												

Signal upstream of Movement 2 _____ ft Movement 5 _____ ft

Length of study period (h) .25

Output Data

	Lane	Movement	Flow Rate (veh/h)	Capacity (veh/h)	v/c	Queue Length (veh)	Control Delay (s)	LOS	Approach Delay and LOS
NB	1	R	522	705	.741	7	23.2	C	23.2
	2								
	3								C
SB	1								
	2								
	3								
		①							
		④	617	869	.71	6	18.6	C	

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CHAPTER 16 - OPERATIONAL ANALYSIS - SUMMARY WORKSHEET

General Information

Analyst	WY	Jurisdiction/Date	1/16/05
Agency or Company	M&E	EB/WB Street	RICE ST
Analysis Period/Year	2015 PMRE	NB/SB Street	HALEKO ST
Comment	2015 REC PM PK HR		

Intersection Data

Area type Other Analysis period .25 h Signal type Actuated-Field % Back of queue 95

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Volume (veh/h)		260	390	555	335				470			
RTOR volume (veh/h)			50			0			40			
Peak-hour factor		.92	.92	.92	.92				.92			
Heavy vehicles (%)		2	2	2	2				2			
Start-up lost time, l_1 (s)		2	2	2	2				2			
Extension of effective green, e (s)		2	2	2	2				2			
Arrival type, AT		3	3	3	3				3			
Approach pedestrian volume (p/h)		50			0			50				
Approach bicycle volume (bic/h)		0			0			0				
Left/right parking (Y or N)	N	/	N	N	/	N	N	/	N		/	

Signal Phasing Plan

L: LT T: TH R: RT P: Peds

	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Phase 6	Phase 7	Phase 8
EB		TRP						
WB	LT	LT						
NB			R					
SB								
Green (s)	9	31	25					
Yellow + All red (s)	5	5	5					

Cycle (s) 80 Lost time per cycle (s) 15 Critical v/c Ratio .928

Intersection Performance

	EB		WB		NB		SB	
Lane group configuration	TR		Def	T		R		
No. of lanes	1		1	1		1		
Flow rate (veh/h)	598		603	364		424		
Capacity (veh/h)	665		842	1040		452		
Adjusted saturation flow (veh/h)	1717		1770	1848		1445		
v/c ratio	.899		.716	.35		.939		
g/C ratio	.388		.563	.563		.313		
Average back of queue (veh)	15.7		10.4	4.8		12.3		
Uniform delay (s)	23		20	9.5		26.8		
Incremental delay (s)	15.2		2.9	0		27.6		
Initial queue delay (s)	0		0	0		0		
Delay (s)	38.2		22.9	9.5		54.4		
LOS	D		C	A		D		
Approach delay (s)/LOS	38.2 / D		17.9 / B		54.4 / D		/	
Intersection delay (s)/ LOS	31.8 / C							

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RICE STREET/KUHIO HIGHWAY

CHAPTER 16 - OPERATIONAL ANALYSIS - SUMMARY WORKSHEET

General Information

Analyst: WY
Agency or Company:
Analysis Period/Year: 2003 AMEX
Comment: 2003 EXISTING AM PEAK HOUR

Site Information

Jurisdiction/Date: 10/28/03
EB/WB Street: RICE ST
NB/SB Street: KUHIO/KAMU

Intersection Data

Area type: Other Analysis period: .25 h Signal type: Pretimed % Back of queue: 70

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Volume (veh/h)				225		60		765		215	745	
RTOR volume (veh/h)						50			0			0
Peak-hour factor				.9	.9	.9	.9	.9	.9	.9	.9	.9
Heavy vehicles (%)				2		2		2		2	2	
Start-up lost time, l_1 (s)				2		2		2		2	2	
Extension of effective green, e (s)				2		2		2		2	2	
Arrival type, AT				3		3		3		3	3	
Approach pedestrian volume (p/h)					0			10			10	
Approach bicycle volume (bic/h)					0			0			0	
Left/right parking (Y or N)		/		N	/	N	N	/	N	N	/	N

Signal Phasing Plan

L: LT T: TH R: RT P: Peds

	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Phase 6	Phase 7	Phase 8
EB								
WB			LR					
NB		T						
SB	LT	LT						
Green (s)	5	41	17					
Yellow + All red (s)	6	6	5					

Cycle (s): 80 Lost time per cycle (s): 6 Critical v/c Ratio: .521

Intersection Performance

	EB			WB			NB			SB		
Lane group configuration				L		R		T		L	T	
No. of lanes				1		1		2		1	2	
Flow rate (veh/h)				250		11		850		239	828	
Capacity (veh/h)				380		340		1799		379	2328	
Adjusted saturation flow (veh/h)				1787		1599		3511		1787	3582	
v/c ratio				.658		.033		.472		.63	.356	
g/C ratio				.213		.213		.513		.65	.65	
Average back of queue (veh)				6.1		.2		7.3		3.5	5.1	
Uniform delay (s)				28.8		25		12.5		7.3	6.4	
Incremental delay (s)				8.6		.2		.9		7.7	.4	
Initial queue delay (s)				0		0		0		0	0	
Delay (s)				37.4		25.2		13.4		15	6.8	
LOS				D		C		B		B	A	
Approach delay (s)/LOS		/		36.9	/	D	13.4	/	B	8.6	/	A
Intersection delay (s)/ LOS	13.9			/			B					

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CHAPTER 16 - OPERATIONAL ANALYSIS - SUMMARY WORKSHEET

General Information

Analyst: WY
Agency or Company: M&E
Analysis Period/Year: 2015 AM AMB1
Comment: 2015 AMBIENT AM PK HR FORECAST

Site Information

Jurisdiction/Date: 1/21/05
EB/WB Street: RICE ST
NB/SB Street: KUHIO/KAMU

Intersection Data

Area type: Other Analysis period: .25 h Signal type: Pretimed % Back of queue: 70

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Volume (veh/h)				265		70		910		250	895	
RTOR volume (veh/h)						50			0			0
Peak-hour factor				.9	.9	.9	.9	.9	.9	.9	.9	.9
Heavy vehicles (%)				2		2		2		2	2	
Start-up lost time, l_1 (s)				2		2		2		2	2	
Extension of effective green, e (s)				2		2		2		2	2	
Arrival type, AT				3		3		3		3	3	
Approach pedestrian volume (p/h)					0			10			10	
Approach bicycle volume (bic/h)					0			0			0	
Left/right parking (Y or N)		/		N	/	N	N	/	N	N	/	N

Signal Phasing Plan

L: LT T: TH R: RT P: Peds

	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Phase 6	Phase 7	Phase 8
EB								
WB			LR					
NB		T						
SB	LT	LT						
Green (s)	5	41	17					
Yellow + All red (s)	6	6	5					

Cycle (s): 80 Lost time per cycle (s): 6 Critical v/c Ratio: .76

Intersection Performance

	EB			WB			NB			SB		
Lane group configuration				L		R		T		L	T	
No. of lanes				1		1		2		1	2	
Flow rate (veh/h)				294		22		1011		278	994	
Capacity (veh/h)				380		340		1799		317	2328	
Adjusted saturation flow (veh/h)				1787		1599		3511		1787	3582	
v/c ratio				.775		.065		.562		.877	.427	
g/C ratio				.213		.213		.513		.65	.65	
Average back of queue (veh)				7.8		.4		9.3		6.3	6.5	
Uniform delay (s)				29.7		25.2		13.4		9.6	6.8	
Incremental delay (s)				14.3		.4		1.3		27.2	.6	
Initial queue delay (s)				0		0		0		0	0	
Delay (s)				44		25.6		14.7		36.8	7.4	
LOS				D		C		B		D	A	
Approach delay (s)/LOS		/		42.7	/	D	14.7	/	B	13.8	/	B
Intersection delay (s)/ LOS	17.7			/			B					

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CHAPTER 16 - OPERATIONAL ANALYSIS - SUMMARY WORKSHEET

General Information

Analyst: WY
Agency or Company: M&E
Analysis Period/Year: 2015 AM AMB2
Comment: 2015 AMBAMFC W/KUHIO-HARDY SIGNAL

Site Information

Jurisdiction/Date: 1/21/05
EB/WB Street: RICE ST
NB/SB Street: KUHIO/KAMU

Intersection Data

Area type: Other | Analysis period: .25 h | Signal type: Pretimed | % Back of queue: 70

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Volume (veh/h)				155		70		910		190	1005	
RTOR volume (veh/h)						50			0			0
Peak-hour factor				.9	.9	.9	.9	.9	.9	.9	.9	.9
Heavy vehicles (%)				2		2		2		2	2	
Start-up lost time, l_1 (s)				2		2		2		2	2	
Extension of effective green, e (s)				2		2		2		2	2	
Arrival type, AT				3		3		3		3	3	
Approach pedestrian volume (p/h)					0			10			10	
Approach bicycle volume (bic/h)					0			0			0	
Left/right parking (Y or N)		/		N	/	N	N	/	N	N	/	N

Signal Phasing Plan

L: LT T: TH R: RT P: Peds

	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Phase 6	Phase 7	Phase 8
EB								
WB			LR					
NB		T						
SB	LT	LT						
Green (s)	5	41	17					
Yellow + All red (s)	6	6	5					

Cycle (s): 80 | Lost time per cycle (s): 12 | Critical v/c Ratio: .526

Intersection Performance

	EB			WB			NB			SB		
Lane group configuration				L		R		T		L	T	
No. of lanes				1		1		2		1	2	
Flow rate (veh/h)				172		22		1011		211	1117	
Capacity (veh/h)				380		340		1799		317	2328	
Adjusted saturation flow (veh/h)				1787		1599		3511		1787	3582	
v/c ratio				.453		.065		.562		.667	.48	
g/C ratio				.213		.213		.513		.65	.65	
Average back of queue (veh)				3.8		.4		9.3		3.3	7.7	
Uniform delay (s)				27.5		25.2		13.4		8.3	7.1	
Incremental delay (s)				3.9		.4		1.3		10.6	.7	
Initial queue delay (s)				0		0		0		0	0	
Delay (s)				31.4		25.6		14.7		18.9	7.8	
LOS				C		C		B		B	A	
Approach delay (s)/LOS		/		30.7	/	C	14.7	/	B	9.6	/	A
Intersection delay (s)/ LOS		13.2			/			B				

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CHAPTER 16 - OPERATIONAL ANALYSIS - SUMMARY WORKSHEET

General Information

Analyst: WY
Agency or Company: M&E
Analysis Period/Year: 2015 AM20RE
Comment: 2015 20% AM PK HR W/RCMNDED PLAN

Site Information

Jurisdiction/Date: 1/15/05
EB/WB Street: RICE ST
NB/SB Street: KUHIO/KAMU

Intersection Data

Area type: Other | Analysis period: .25 h | Signal type: Pretimed | % Back of queue: 70

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Volume (veh/h)				220		70		1065		280	1005	
RTOR volume (veh/h)						50			0			0
Peak-hour factor				.9	.9	.9	.9	.9	.9	.9	.9	.9
Heavy vehicles (%)				2		2		2		2	2	
Start-up lost time, l_1 (s)				2		2		2		2	2	
Extension of effective green, e (s)				2		2		2		2	2	
Arrival type, AT				3		3		3		3	3	
Approach pedestrian volume (p/h)					0			10			10	
Approach bicycle volume (bic/h)					0			0			0	
Left/right parking (Y or N)		/		N	/	N	N	/	N	N	/	N

Signal Phasing Plan

L: LT T: TH R: RT P: Peds

	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Phase 6	Phase 7	Phase 8
EB								
WB			LR					
NB		T						
SB	LT	LT						
Green (s)	8	43	17					
Yellow + All red (s)	6	6	5					

Cycle (s): 85 | Lost time per cycle (s): 6 | Critical v/c Ratio: .872

Intersection Performance

	EB			WB			NB			SB		
Lane group configuration				L		R		T		L	T	
No. of lanes				1		1		2		1	2	
Flow rate (veh/h)				244		22		1183		311	1117	
Capacity (veh/h)				357		320		1776		310	2402	
Adjusted saturation flow (veh/h)				1787		1599		3511		1787	3582	
v/c ratio				.684		.069		.666		1.002	.465	
g/C ratio				.2		.2		.506		.671	.671	
Average back of queue (veh)				6.4		.5		12.9		10.9	7.7	
Uniform delay (s)				31.5		27.6		15.7		17.7	6.7	
Incremental delay (s)				10.2		.4		2		51.7	.6	
Initial queue delay (s)				0		0		0		0	0	
Delay (s)				41.7		28		17.7		69.4	7.3	
LOS				D		C		B		E	A	
Approach delay (s)/LOS		/		40.6	/	D	17.7	/	B	20.8	/	C
Intersection delay (s)/ LOS		21.4			/			C				

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CHAPTER 16 - OPERATIONAL ANALYSIS - SUMMARY WORKSHEET

General Information

Analyst: WY
Agency or Company:
Analysis Period/Year: 2003 PMEX
Comment: 2003 EXISTING PM PEAK HOUR

Site Information

Jurisdiction/Date: 10/28/03
EB/WB Street: RICE ST
NB/SB Street: KUHIO/KAMU

Intersection Data

Area type: Other Analysis period: .25 h Signal type: Pretimed % Back of queue: 70

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Volume (veh/h)				300		90		900		180	730	
RTOR volume (veh/h)						70			0			0
Peak-hour factor				.9	.9	.9	.9	.9	.9	.9	.9	.9
Heavy vehicles (%)				2		2		2		2	2	
Start-up lost time, l_1 (s)				2		2		2		2	2	
Extension of effective green, e (s)				2		2		2		2	2	
Arrival type, AT				3		3		3		3	3	
Approach pedestrian volume (p/h)				0			10			10		
Approach bicycle volume (bic/h)				0			0			0		
Left/right parking (Y or N)		/		N	/	N	N	/	N	N	/	N

Signal Phasing Plan

L: LT T: TH R: RT P: Peds

	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Phase 6	Phase 7	Phase 8
EB								
WB			LR					
NB		T						
SB	LT	LT						
Green (s)	5	40	18					
Yellow + All red (s)	6	6	5					

Cycle (s): 80 Lost time per cycle (s): 12 Critical v/c Ratio: .628

Intersection Performance

	EB			WB			NB			SB		
Lane group configuration				L		R		T		L	T	
No. of lanes				1		1		2		1	2	
Flow rate (veh/h)				333		22		1000		200	811	
Capacity (veh/h)				402		360		1756		311	2284	
Adjusted saturation flow (veh/h)				1787		1599		3511		1787	3582	
v/c ratio				.829		.062		.57		.643	.355	
g/C ratio				.225		.225		.5		.638	.638	
Average back of queue (veh)				9.2		.4		9.4		3.1	5.1	
Uniform delay (s)				29.5		24.4		14		8.6	6.8	
Incremental delay (s)				17.6		.3		1.3		9.8	.4	
Initial queue delay (s)				0		0		0		0	0	
Delay (s)				47.1		24.7		15.3		18.4	7.2	
LOS				D		C		B		B	A	
Approach delay (s)/LOS		/		45.7	/	D	15.3	/	B	9.4	/	A
Intersection delay (s)/ LOS		17.3		/			B					

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CHAPTER 16 - OPERATIONAL ANALYSIS - SUMMARY WORKSHEET

General Information

Analyst: WY
Agency or Company: M&E
Analysis Period/Year: 2015 PM AMB1
Comment: 2015 AMBINET PM PK HR FORECAST

Site Information

Jurisdiction/Date: 1/21/05
EB/WB Street: RICE ST
NB/SB Street: KUHIO/KAMU

Intersection Data

Area type: Other Analysis period: .25 h Signal type: Pretimed % Back of queue: 70

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Volume (veh/h)				350		105		1075		215	870	
RTOR volume (veh/h)						70			0			0
Peak-hour factor				.9	.9	.9	.9	.9	.9	.9	.9	.9
Heavy vehicles (%)				2		2		2		2	2	
Start-up lost time, l_1 (s)				2		2		2		2	2	
Extension of effective green, e (s)				2		2		2		2	2	
Arrival type, AT				3		3		3		3	3	
Approach pedestrian volume (p/h)				0			10			10		
Approach bicycle volume (bic/h)				0			0			0		
Left/right parking (Y or N)		/		N	/	N	N	/	N	N	/	N

Signal Phasing Plan

L: LT T: TH R: RT P: Peds

	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Phase 6	Phase 7	Phase 8
EB								
WB			LR					
NB		T						
SB	LT	LT						
Green (s)	8	34	21					
Yellow + All red (s)	6	6	5					

Cycle (s): 80 Lost time per cycle (s): 12 Critical v/c Ratio: .774

Intersection Performance

	EB			WB			NB			SB		
Lane group configuration				L		R		T		L	T	
No. of lanes				1		1		2		1	2	
Flow rate (veh/h)				389		39		1194		239	967	
Capacity (veh/h)				469		420		1492		273	2149	
Adjusted saturation flow (veh/h)				1787		1599		3511		1787	3582	
v/c ratio				.829		.093		.8		.876	.45	
g/C ratio				.263		.263		.425		.6	.6	
Average back of queue (veh)				10.6		.7		15.2		6.1	7.1	
Uniform delay (s)				27.8		22.3		20		18.4	8.8	
Incremental delay (s)				15.5		.4		4.6		30.2	.7	
Initial queue delay (s)				0		0		0		0	0	
Delay (s)				43.3		22.7		24.6		48.6	9.5	
LOS				D		C		C		D	A	
Approach delay (s)/LOS		/		41.4	/	D	24.6	/	C	17.2	/	B
Intersection delay (s)/ LOS		24		/			C					

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CHAPTER 16 - OPERATIONAL ANALYSIS - SUMMARY WORKSHEET

General Information

Analyst: WY
Agency or Company: M&E
Analysis Period/Year: 2015 PM AMB2
Comment: 2015 AMB PM FC W/KUHIO-HARDY SIGNAL

Site Information

Jurisdiction/Date: 1/21/05
EB/WB Street: RICE ST
NB/SB Street: KUHIO/KAMU

Intersection Data

Area type: Other Analysis period: .25 h Signal type: Pretimed % Back of queue: 70

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Volume (veh/h)				240		105		1075		155	980	
RTOR volume (veh/h)						70			0			0
Peak-hour factor				.9	.9	.9	.9	.9	.9	.9	.9	.9
Heavy vehicles (%)				2		2		2		2	2	
Start-up lost time, l_1 (s)				2		2		2		2	2	
Extension of effective green, e (s)				2		2		2		2	2	
Arrival type, AT				3		3		3		3	3	
Approach pedestrian volume (p/h)				0			10			10		
Approach bicycle volume (bic/h)				0			0			0		
Left/right parking (Y or N)		/		N	/	N	N	/	N	N	/	N

Signal Phasing Plan

L: LT T: TH R: RT P: Peds

	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Phase 6	Phase 7	Phase 8
EB								
WB			LR					
NB		T						
SB	LT	LT						
Green (s)	5	40	18					
Yellow + All red (s)	6	6	5					

Cycle (s): 80 Lost time per cycle (s): 12 Critical v/c Ratio: .649

Intersection Performance

	EB			WB			NB			SB		
Lane group configuration				L		R		T		L	T	
No. of lanes				1		1		2		1	2	
Flow rate (veh/h)				267		39		1194		172	1089	
Capacity (veh/h)				402		360		1756		249	2284	
Adjusted saturation flow (veh/h)				1787		1599		3511		1787	3582	
v/c ratio				.663		.108		.68		.693	.477	
g/C ratio				.225		.225		.5		.638	.638	
Average back of queue (veh)				6.4		.7		12.6		3	7.7	
Uniform delay (s)				28.2		24.6		15.2		10.5	7.6	
Incremental delay (s)				8.4		.6		2.2		14.8	.7	
Initial queue delay (s)				0		0		0		0	0	
Delay (s)				36.6		25.2		17.4		25.3	8.3	
LOS				D		C		B		C	A	
Approach delay (s)/LOS		/		35.2	/	D	17.4	/	B	10.6	/	B
Intersection delay (s)/ LOS		16.2		/		B						

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CHAPTER 16 - OPERATIONAL ANALYSIS - SUMMARY WORKSHEET

General Information

Analyst: WY
Agency or Company: M&E
Analysis Period/Year: 2015 PMRE
Comment: 2015 PM PEAK HOUR W/RECOMNDED PLAN

Site Information

Jurisdiction/Date: 1/10/05
EB/WB Street: RICE ST
NB/SB Street: KUHIO/KAMU

Intersection Data

Area type: Other Analysis period: .25 h Signal type: Pretimed % Back of queue: 70

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Volume (veh/h)				205		65		915		260	940	
RTOR volume (veh/h)						70			0			0
Peak-hour factor				.9	.9	.9	.9	.9	.9	.9	.9	.9
Heavy vehicles (%)				2		2		2		2	2	
Start-up lost time, l_1 (s)				2		2		2		2	2	
Extension of effective green, e (s)				2		2		2		2	2	
Arrival type, AT				3		3		3		3	3	
Approach pedestrian volume (p/h)				0			10			10		
Approach bicycle volume (bic/h)				0			0			0		
Left/right parking (Y or N)		/		N	/	N	N	/	N	N	/	N

Signal Phasing Plan

L: LT T: TH R: RT P: Peds

	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Phase 6	Phase 7	Phase 8
EB								
WB			LR					
NB		T						
SB	LT	LT						
Green (s)	5	40	18					
Yellow + All red (s)	6	6	5					

Cycle (s): 80 Lost time per cycle (s): 6 Critical v/c Ratio: .774

Intersection Performance

	EB			WB			NB			SB		
Lane group configuration				L		R		T		L	T	
No. of lanes				1		1		2		1	2	
Flow rate (veh/h)				228		-6		1017		289	1044	
Capacity (veh/h)				402		360		1756		305	2284	
Adjusted saturation flow (veh/h)				1787		1599		3511		1787	3582	
v/c ratio				.566		-.015		.579		.946	.457	
g/C ratio				.225		.225		.5		.638	.638	
Average back of queue (veh)				5.2		-.1		9.7		7.9	7.2	
Uniform delay (s)				27.5		23.9		14.1		11.6	7.4	
Incremental delay (s)				5.7		0		1.4		39.5	.7	
Initial queue delay (s)				0		0		0		0	0	
Delay (s)				33.2		23.9		15.5		51.1	8.1	
LOS				C		C		B		D	A	
Approach delay (s)/LOS		/		33.5	/	C	15.5	/	B	17.4	/	B
Intersection delay (s)/ LOS		18		/		B						

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HARDY STREET/KUHIO HIGHWAY

CHAPTER 17 - TWSC - UNSIGNALIZED INTERSECTIONS WORKSHEET

Analysis Summary

General Information

Analyst	WY	Jurisdiction/Date	10/28/03
Agency or Company		Major Street	KUHIO HWY
Analysis Period/Year	2003 AMEX	Minor Street	HARDY ST
Comment	2003 EXISTING AM PEAK HOUR		

Input Data

Lane Configuration	SB			NB			EB			WB		
Lane 1 (curb)		T			TR						R	
Lane 2		L			T						L	
Lane 3												
	SB			NB			EB			WB		
Movement	1 (LT)	2 (TH)	3 (RT)	4 (LT)	5 (TH)	6 (RT)	7 (LT)	8 (TH)	9 (RT)	10 (LT)	11 (TH)	12 (RT)
Volume (veh/h)	355	945			615	190				30		230
PHF	.9	.9			.9	.9				.9		.9
Proportion of heavy vehicles, HV	3	3			3	3				3		3
Flow rate	394	1050			683	211				33		256
Flare storage (# of vehs)												0
Median storage (# of vehs)										0		

Signal upstream of Movement 2 _____ ft Movement 5 _____ ft

Length of study period (h) .25

Output Data

	Lane	Movement	Flow Rate (veh/h)	Capacity (veh/h)	v/c	Queue Length (veh)	Control Delay (s)	LOS	Approach Delay and LOS
EB	1								
	2								
	3								
WB	1	R	256	556	.46	2	16.9	C	211.1
	2	L	30	9	3.337	5	1868	F	
	3								F
		①	394	748	.527	3	15.1	C	
		④							

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CHAPTER 17 - TWSC - UNSIGNALIZED INTERSECTIONS WORKSHEET

Analysis Summary

General Information

Analyst	WY	Jurisdiction/Date	1/21/05
Agency or Company	M&E	Major Street	KUHIO HWY
Analysis Period/Year	2015 AM AMB1	Minor Street	HARDY ST
Comment	2015 AMBIENT AM PK HR FORECAST		

Input Data

Lane Configuration	SB			NB			EB			WB		
Lane 1 (curb)		T			TR						R	
Lane 2		L			T						L	
Lane 3												
	SB			NB			EB			WB		
Movement	1 (LT)	2 (TH)	3 (RT)	4 (LT)	5 (TH)	6 (RT)	7 (LT)	8 (TH)	9 (RT)	10 (LT)	11 (TH)	12 (RT)
Volume (veh/h)	395	1130			730	225				35		255
PHF	.9	.9			.9	.9				.9		.9
Proportion of heavy vehicles, HV	3	3			3	3				3		3
Flow rate	439	1256			811	250				39		283
Flare storage (# of vehs)												0
Median storage (# of vehs)										0		

Signal upstream of Movement 2 _____ ft Movement 5 _____ ft

Length of study period (h) .25

Output Data

	Lane	Movement	Flow Rate (veh/h)	Capacity (veh/h)	v/c	Queue Length (veh)	Control Delay (s)	LOS	Approach Delay and LOS
EB	1								
	2								
	3								
WB	1	R	283	490	.577	4	21.9	C	627.6
	2	L	30	3	10.044	5	6342	F	
	3								F
		①	439	646	.679	5	21.5	C	
		④							

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CHAPTER 16 - OPERATIONAL ANALYSIS - SUMMARY WORKSHEET

General Information

Analyst: WY
Agency or Company: M&E
Analysis Period/Year: 2015 AM AMB2
Comment: 2015 AMB PM FC W/KUHIO-HARDY SIGNAL

Site Information

Jurisdiction/Date: 1/21/05
EB/WB Street: HARDY ST
NB/SB Street: KUHIO HWY

Intersection Data

Area type: Other Analysis period: .25 h Signal type: Actuated-Field % Back of queue: 95

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Volume (veh/h)				150		255		730	225	455	1035	
RTOR volume (veh/h)						50			80			0
Peak-hour factor				.92		.92		.92	.92	.92	.92	
Heavy vehicles (%)				2		2		2	2	2	2	
Start-up lost time, l_1 (s)				2		2		2	2	2	2	
Extension of effective green, e (s)				2		2		2	2	2	2	
Arrival type, AT				4	4	4	4	4	4	4	4	4
Approach pedestrian volume (p/h)					50			50			50	
Approach bicycle volume (bic/h)					0			0			0	
Left/right parking (Y or N)		/		N	/	N	N	/	N	N	/	N

Signal Phasing Plan

L: LT T: TH R: RT P: Peds

	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Phase 6	Phase 7	Phase 8
EB								
WB	LRP							
NB			TRP					
SB		LT	LT					
Green (s)	20	13	32					
Yellow + All red (s)	5	5	5					

Cycle (s): 80 Lost time per cycle (s): 10 Critical v/c Ratio: .887

Intersection Performance

	EB			WB			NB			SB		
Lane group configuration				L		R		T	R	L	T	
No. of lanes				1		1		2	1	1	2	
Flow rate (veh/h)				163		223		793	158	495	1125	
Capacity (veh/h)				447		376		1404	627	493	2239	
Adjusted saturation flow (veh/h)				1787		1503		3511	1567	1787	3582	
v/c ratio				.365		.593		.565	.251	1.003	.502	
g/C ratio				.25		.25		.4	.4	.625	.625	
Average back of queue (veh)				3		4.6		6.9	2.1	10	4.5	
Uniform delay (s)				24.8		26.4		18.6	16	13.5	8.2	
Incremental delay (s)				0		2.5		.5	0	41.1	.2	
Initial queue delay (s)				0		0		0	0	0	0	
Delay (s)				24.8		28.9		17.1	14.3	48	4.4	
LOS				C		C		B	B	D	A	
Approach delay (s)/LOS		/		27.2	/	C	16.7	/	B	17.7	/	B
Intersection delay (s)/ LOS		18.6		/			B					

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CHAPTER 16 - OPERATIONAL ANALYSIS - SUMMARY WORKSHEET

General Information

Analyst: WY
Agency or Company: M&E
Analysis Period/Year: 2015 AM20RE
Comment: 2015 20% AM PK HR PLAN RECMNDED PLA

Site Information

Jurisdiction/Date: 1/15/05
EB/WB Street: HARDY ST
NB/SB Street: KUHIO HWY

Intersection Data

Area type: Other Analysis period: .25 h Signal type: Actuated-Field % Back of queue: 95

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Volume (veh/h)				175		270		740	275	430	1125	
RTOR volume (veh/h)						50			80			0
Peak-hour factor				.92		.92		.92	.92	.92	.92	
Heavy vehicles (%)				2		2		2	2	2	2	
Start-up lost time, l_1 (s)				2		2		2	2	2	2	
Extension of effective green, e (s)				2		2		2	2	2	2	
Arrival type, AT				4	4	4	4	4	4	4	4	4
Approach pedestrian volume (p/h)					50			50			50	
Approach bicycle volume (bic/h)					0			0			0	
Left/right parking (Y or N)		/		N	/	N	N	/	N	N	/	N

Signal Phasing Plan

L: LT T: TH R: RT P: Peds

	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Phase 6	Phase 7	Phase 8
EB								
WB	LRP							
NB			TRP					
SB		LT	LT					
Green (s)	20	12	38					
Yellow + All red (s)	5	5	5					

Cycle (s): 85 Lost time per cycle (s): 10 Critical v/c Ratio: .852

Intersection Performance

	EB			WB			NB			SB		
Lane group configuration				L		R		T	R	L	T	
No. of lanes				1		1		2	1	1	2	
Flow rate (veh/h)				190		239		804	212	467	1223	
Capacity (veh/h)				421		352		1570	701	493	2318	
Adjusted saturation flow (veh/h)				1787		1497		3511	1567	1787	3582	
v/c ratio				.452		.679		.512	.302	.947	.528	
g/C ratio				.235		.235		.447	.447	.647	.647	
Average back of queue (veh)				3.9		5.6		6.4	2.7	7.3	4.7	
Uniform delay (s)				27.8		29.6		16.9	15	10	8	
Incremental delay (s)				.5		5.2		.3	0	27.7	.2	
Initial queue delay (s)				0		0		0	0	0	0	
Delay (s)				28.3		34.8		14.5	12.6	32.2	3.8	
LOS				C		C		B	B	C	A	
Approach delay (s)/LOS		/		31.9	/	C	14.1	/	B	11.6	/	B
Intersection delay (s)/ LOS		15.2		/			B					

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CHAPTER 17 - TWSC - UNSIGNALIZED INTERSECTIONS WORKSHEET

Analysis Summary

General Information

Analyst	WY
Agency or Company	
Analysis Period/Year	2003 PMEX
Comment	2003 EXISTING PM PEAK HOUR

Site Information

Jurisdiction/Date	10/28/03
Major Street	KUHIO HWY
Minor Street	HARDY ST

Input Data

Lane Configuration	SB			NB			EB			WB		
Lane 1 (curb)		T			TR							R
Lane 2		L			T							L
Lane 3												
	SB			NB			EB			WB		
Movement	1 (LT)	2 (TH)	3 (RT)	4 (LT)	5 (TH)	6 (RT)	7 (LT)	8 (TH)	9 (RT)	10 (LT)	11 (TH)	12 (RT)
Volume (veh/h)	240	930			845	107				70		335
PHF	.9	.9			.9	.9				.9		.9
Proportion of heavy vehicles, HV	3	3			3	3				3		3
Flow rate	267	1033			939	119				78		372
Flare storage (# of vehs)												0
Median storage (# of vehs)										0		

Signal upstream of Movement 2 _____ ft Movement 5 _____ ft

Length of study period (h) .25

Output Data

	Lane	Movement	Flow Rate (veh/h)	Capacity (veh/h)	v/c	Queue Length (veh)	Control Delay (s)	LOS	Approach Delay and LOS
EB	1								
	2								
	3								
WB	1	R	372	492	.757	6	31.7	D	453.9
	2	L	70	12	5.653	10	2697.7	F	
	3								F
		①	267	648	.411	2	14.4	B	
		④							

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CHAPTER 17 - TWSC - UNSIGNALIZED INTERSECTIONS WORKSHEET

Analysis Summary

General Information

Analyst	WY
Agency or Company	M&E
Analysis Period/Year	2015 PM AMB1
Comment	2015 AMBINET PM PK HR FORECAST

Site Information

Jurisdiction/Date	1/21/05
Major Street	KUHIO HWY
Minor Street	HARDY ST

Input Data

Lane Configuration	SB			NB			EB			WB		
Lane 1 (curb)		T			TR							R
Lane 2		L			T							L
Lane 3												
	SB			NB			EB			WB		
Movement	1 (LT)	2 (TH)	3 (RT)	4 (LT)	5 (TH)	6 (RT)	7 (LT)	8 (TH)	9 (RT)	10 (LT)	11 (TH)	12 (RT)
Volume (veh/h)	260	1115			1005	120				80		335
PHF	.9	.9			.9	.9				.9		.9
Proportion of heavy vehicles, HV	3	3			3	3				3		3
Flow rate	289	1239			1117	133				89		372
Flare storage (# of vehs)												0
Median storage (# of vehs)										0		

Signal upstream of Movement 2 _____ ft Movement 5 _____ ft

Length of study period (h) .25

Output Data

	Lane	Movement	Flow Rate (veh/h)	Capacity (veh/h)	v/c	Queue Length (veh)	Control Delay (s)	LOS	Approach Delay and LOS
EB	1								
	2								
	3								
WB	1	R	372	425	.875	9	49.5	E	1512.2
	2	L	80	5	16.266	12	8313.7	F	
	3								F
		①	289	547	.528	3	18.7	C	
		④							

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CHAPTER 16 - OPERATIONAL ANALYSIS - SUMMARY WORKSHEET

General Information

Analyst: WY
Agency or Company: M&E
Analysis Period/Year: 2015 PM AMB2
Comment: 2015 AMB PM FC W/KUHIO-HARDY SIGNAL

Site Information

Jurisdiction/Date: 1/21/05
EB/WB Street: HARDY ST
NB/SB Street: KUHIO HWY

Intersection Data

Area type: Other | Analysis period: .25 h | Signal type: Actuated-Field | % Back of queue: 95

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Volume (veh/h)				240		335		1005	120	320	1055	
RTOR volume (veh/h)						50			80			0
Peak-hour factor				.92		.92		.92	.92	.92	.92	
Heavy vehicles (%)				2		2		2	2	2	2	
Start-up lost time, l_1 (s)				2		2		2	2	2	2	
Extension of effective green, e (s)				2		2		2	2	2	2	
Arrival type, AT				4	4	4	4	4	4	4	4	4
Approach pedestrian volume (p/h)				50			50			50		
Approach bicycle volume (bic/h)				0			0			0		
Left/right parking (Y or N)		/		N	/	N	N	/	N	N	/	N

Signal Phasing Plan

L: LT T: TH R: RT P: Peds

	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Phase 6	Phase 7	Phase 8
EB								
WB	LRP							
NB			TRP					
SB		LT	LT					
Green (s)	22	12	30					
Yellow + All red (s)	5	5	5					

Cycle (s): 79 | Lost time per cycle (s): 10 | Critical v/c Ratio: .815

Intersection Performance

	EB			WB			NB			SB		
Lane group configuration				L		R		T	R	L	T	
No. of lanes				1		1		2	1	1	2	
Flow rate (veh/h)				261		310		1092	43	348	1147	
Capacity (veh/h)				498		421		1333	595	367	2131	
Adjusted saturation flow (veh/h)				1787		1513		3511	1567	1787	3582	
v/c ratio				.524		.735		.819	.073	.948	.538	
g/C ratio				.278		.278		.38	.38	.595	.595	
Average back of queue (veh)				4.9		6.9		12.7	.5	6.5	5.6	
Uniform delay (s)				24.1		25.9		22.1	15.6	21	9.5	
Incremental delay (s)				1		6.6		4.2	0	33.8	.3	
Initial queue delay (s)				0		0		0	0	0	0	
Delay (s)				25.1		32.5		24.4	14.3	46.1	5.9	
LOS				C		C		C	B	D	A	
Approach delay (s)/LOS		/		29.1	/	C	24	/	C	15.3	/	B
Intersection delay (s)/ LOS		20.8			/			C				

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CHAPTER 16 - OPERATIONAL ANALYSIS - SUMMARY WORKSHEET

General Information

Analyst: WY
Agency or Company: M&E
Analysis Period/Year: 2015 PMRE
Comment: 2015 RECMNDED PM PK HR PLAN

Site Information

Jurisdiction/Date: 1/11/05
EB/WB Street: HARDY ST
NB/SB Street: KUHIO HWY

Intersection Data

Area type: Other | Analysis period: .25 h | Signal type: Actuated-Field | % Back of queue: 95

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Volume (veh/h)				320		355		1025	240	285	1115	
RTOR volume (veh/h)						50			80			0
Peak-hour factor				.92		.92		.92	.92	.92	.92	
Heavy vehicles (%)				2		2		2	2	2	2	
Start-up lost time, l_1 (s)				2		2		2	2	2	2	
Extension of effective green, e (s)				2		2		2	2	2	2	
Arrival type, AT				4	4	4	4	4	4	4	4	4
Approach pedestrian volume (p/h)				50			50			50		
Approach bicycle volume (bic/h)				0			0			0		
Left/right parking (Y or N)		/		N	/	N	N	/	N	N	/	N

Signal Phasing Plan

L: LT T: TH R: RT P: Peds

	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Phase 6	Phase 7	Phase 8
EB								
WB	LRP							
NB			TRP					
SB		LT	LT					
Green (s)	25	10	30					
Yellow + All red (s)	5	5	5					

Cycle (s): 80 | Lost time per cycle (s): 10 | Critical v/c Ratio: .851

Intersection Performance

	EB			WB			NB			SB		
Lane group configuration				L		R		T	R	L	T	
No. of lanes				1		1		2	1	1	2	
Flow rate (veh/h)				348		332		1114	174	310	1212	
Capacity (veh/h)				559		476		1317	588	317	2015	
Adjusted saturation flow (veh/h)				1787		1522		3511	1567	1787	3582	
v/c ratio				.623		.697		.846	.296	.976	.601	
g/C ratio				.313		.313		.375	.375	.563	.563	
Average back of queue (veh)				6.8		7		13.7	2.5	6.8	7.4	
Uniform delay (s)				23.5		24.2		22.9	17.6	20.9	11.6	
Incremental delay (s)				2.2		4.4		5.3	0	43.8	.5	
Initial queue delay (s)				0		0		0	0	0	0	
Delay (s)				25.1		28		26.4	16.2	57.5	8.1	
LOS				C		C		C	B	E	A	
Approach delay (s)/LOS		/		26.5	/	C	25	/	C	18.2	/	B
Intersection delay (s)/ LOS		22.3			/			C				

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HARDY STREET/BIG SAVE-COUNTY DRIVEWAY

CHAPTER 17 - TWSC - UNSIGNALIZED INTERSECTIONS WORKSHEET

Analysis Summary

General Information

Analyst	WY	Jurisdiction/Date	1/21/05
Agency or Company	M&E	Major Street	HARDY ST
Analysis Period/Year	2004 AM EX	Minor Street	BIG SAVE DRIVEWAY
Comment	2004 EXISTING AM		

Input Data

Lane Configuration	EB			WB			NB			SB		
Lane 1 (curb)		TR			LT			LR				
Lane 2												
Lane 3												
	EB			WB			NB			SB		
Movement	1 (LT)	2 (TH)	3 (RT)	4 (LT)	5 (TH)	6 (RT)	7 (LT)	8 (TH)	9 (RT)	10 (LT)	11 (TH)	12 (RT)
Volume (veh/h)		480	55	45	225		25		35			
PHF		.9	.9	.9	.9		.9		.9			
Proportion of heavy vehicles, HV		3	3	3	3		3		3			
Flow rate		533	61	50	250		28		39			
Flare storage (# of vehs)									0			
Median storage (# of vehs)							0					

Signal upstream of Movement 2 _____ ft Movement 5 _____ ft

Length of study period (h) .25

Output Data

	Lane	Movement	Flow Rate (veh/h)	Capacity (veh/h)	v/c	Queue Length (veh)	Control Delay (s)	LOS	Approach Delay and LOS
NB	1	LR	67	389	.172	1	16.2	C	16.2
	2								
	3								C
SB	1								
	2								
	3								
		①							
		④	50	977	.051	<1	8.9	A	

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CHAPTER 17 - TWSC - UNSIGNALIZED INTERSECTIONS WORKSHEET

Analysis Summary

General Information

Analyst	WY	Jurisdiction/Date	1/21/05
Agency or Company	M&E	Major Street	HARDY ST
Analysis Period/Year	2015 AM AMBI	Minor Street	BIG SAVE DRIVEWAY
Comment	2015 AMBIENT AM PK HR FORECAST		

Input Data

Lane Configuration	EB			WB			NB			SB		
Lane 1 (curb)		TR			LT			LR				
Lane 2												
Lane 3												
	EB			WB			NB			SB		
Movement	1 (LT)	2 (TH)	3 (RT)	4 (LT)	5 (TH)	6 (RT)	7 (LT)	8 (TH)	9 (RT)	10 (LT)	11 (TH)	12 (RT)
Volume (veh/h)		565	45	55	255		20		45			
PHF		.9	.9	.9	.9		.9		.9			
Proportion of heavy vehicles, HV		3	3	3	3		3		3			
Flow rate		628	50	61	283		22		50			
Flare storage (# of vehs)									0			
Median storage (# of vehs)							0					

Signal upstream of Movement 2 _____ ft Movement 5 _____ ft

Length of study period (h) .25

Output Data

	Lane	Movement	Flow Rate (veh/h)	Capacity (veh/h)	v/c	Queue Length (veh)	Control Delay (s)	LOS	Approach Delay and LOS
NB	1	LR	72	355	.203	1	17.7	C	17.7
	2								
	3								C
SB	1								
	2								
	3								
		①							
		④	61	909	.067	<1	9.2	A	

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CHAPTER 17 - TWSC - UNSIGNALIZED INTERSECTIONS WORKSHEET

Analysis Summary

General Information

Analyst	WY	Jurisdiction/Date	1/21/05
Agency or Company	M&E	Major Street	HARDY ST
Analysis Period/Year	2015 AM AMB2	Minor Street	BIG SAVE DRIVEWAY
Comment	2015 AMB AMFC W/KUHIO-HARDY SIGNAL		

Input Data

Lane Configuration	EB			WB			NB			SB		
Lane 1 (curb)		TR			LT			LR				
Lane 2												
Lane 3												
	EB			WB			NB			SB		
Movement	1 (LT)	2 (TH)	3 (RT)	4 (LT)	5 (TH)	6 (RT)	7 (LT)	8 (TH)	9 (RT)	10 (LT)	11 (TH)	12 (RT)
Volume (veh/h)		625	45	55	370		20		45			
PHF		.9	.9	.9	.9		.9		.9			
Proportion of heavy vehicles, HV		3	3	3	3		3		3			
Flow rate		694	50	61	411		22		50			
Flare storage (# of vehs)									0			
Median storage (# of vehs)							0					

Signal upstream of Movement 2 _____ ft Movement 5 _____ ft

Length of study period (h) .25

Output Data

	Lane	Movement	Flow Rate (veh/h)	Capacity (veh/h)	v/c	Queue Length (veh)	Control Delay (s)	LOS	Approach Delay and LOS
NB	1	LR	72	297	.242	1	21	C	21
	2								
	3								C
SB	1								
	2								
	3								
		①							
		④	61	859	.071	<1	9.5	A	

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CHAPTER 17 - TWSC - UNSIGNALIZED INTERSECTIONS WORKSHEET

Analysis Summary

General Information

Analyst	WY	Jurisdiction/Date	1/21/05
Agency or Company	M&E	Major Street	HARDY ST
Analysis Period/Year	2015 AM RE	Minor Street	BIG SAVE DRIVEWAY
Comment	2015 RECOMMENDED AM PK HR FORECAST		

Input Data

Lane Configuration	EB			WB			NB			SB		
Lane 1 (curb)		TR			LT			LR				
Lane 2												
Lane 3												
	EB			WB			NB			SB		
Movement	1 (LT)	2 (TH)	3 (RT)	4 (LT)	5 (TH)	6 (RT)	7 (LT)	8 (TH)	9 (RT)	10 (LT)	11 (TH)	12 (RT)
Volume (veh/h)		675	30		445				45			
PHF		.9	.9	.9	.9		.9		.9			
Proportion of heavy vehicles, HV		3	3	3	3		3		3			
Flow rate		750	33	0	494		0		50			
Flare storage (# of vehs)									0			
Median storage (# of vehs)							0					

Signal upstream of Movement 2 _____ ft Movement 5 _____ ft

Length of study period (h) .25

Output Data

	Lane	Movement	Flow Rate (veh/h)	Capacity (veh/h)	v/c	Queue Length (veh)	Control Delay (s)	LOS	Approach Delay and LOS
NB	1	LR	50	401	.125	<1	15.3	C	15.3
	2								
	3								C
SB	1								
	2								
	3								
		①							
		④	0						

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CHAPTER 17 - TWSC - UNSIGNALIZED INTERSECTIONS WORKSHEET

Analysis Summary

General Information

Analyst	WY	Jurisdiction/Date	1/21/05
Agency or Company	M&E	Major Street	HARDY ST
Analysis Period/Year	2015 AM RE	Minor Street	BIG SAVE DRIVEWAY
Comment	2015 RECOMMENDED AM PK HR FORECAST IF LTS PERMITTED		

Input Data

Lane Configuration	EB	WB	NB	SB
Lane 1 (curb)	TR	LT	LR	
Lane 2				
Lane 3				

	EB			WB			NB			SB		
Movement	1 (LT)	2 (TH)	3 (RT)	4 (LT)	5 (TH)	6 (RT)	7 (LT)	8 (TH)	9 (RT)	10 (LT)	11 (TH)	12 (RT)
Volume (veh/h)		675	30	55	445		20		45			
PHF		.9	.9	.9	.9		.9		.9			
Proportion of heavy vehicles, HV		3	3	3	3		3		3			
Flow rate		750	33	61	494		22		50			
Flare storage (# of vehs)									0			
Median storage (# of vehs)							0					

Signal upstream of Movement 2 _____ ft Movement 5 _____ ft

Length of study period (h) .25

Output Data

	Lane	Movement	Flow Rate (veh/h)	Capacity (veh/h)	v/c	Queue Length (veh)	Control Delay (s)	LOS	Approach Delay and LOS
NB	1	LR	72	261	.276	1	23.9	C	23.9
	2								
	3								C
SB	1								
	2								
	3								
		①							
		④	61	830	.074	<1	9.7	A	

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CHAPTER 17 - TWSC - UNSIGNALIZED INTERSECTIONS WORKSHEET

Analysis Summary

General Information

Analyst	WY	Jurisdiction/Date	1/21/05
Agency or Company	M&E	Major Street	HARDY ST
Analysis Period/Year	2004 PM EX	Minor Street	BIG SAVE DRIVEWAY
Comment	2004 EXISTING PM		

Input Data

Lane Configuration	EB	WB	NB	SB
Lane 1 (curb)	TR	LT	LR	
Lane 2				
Lane 3				

	EB			WB			NB			SB		
Movement	1 (LT)	2 (TH)	3 (RT)	4 (LT)	5 (TH)	6 (RT)	7 (LT)	8 (TH)	9 (RT)	10 (LT)	11 (TH)	12 (RT)
Volume (veh/h)		345	70	40	325		70		75			
PHF		.9	.9	.9	.9		.9		.9			
Proportion of heavy vehicles, HV		3	3	3	3		3		3			
Flow rate		383	78	44	361		78		83			
Flare storage (# of vehs)									0			
Median storage (# of vehs)							0					

Signal upstream of Movement 2 _____ ft Movement 5 _____ ft

Length of study period (h) .25

Output Data

	Lane	Movement	Flow Rate (veh/h)	Capacity (veh/h)	v/c	Queue Length (veh)	Control Delay (s)	LOS	Approach Delay and LOS
NB	1	LR	161	417	.386	2	19	C	19
	2								
	3								C
SB	1								
	2								
	3								
		①							
		④	44	1095	.041	<1	8.4	A	

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CHAPTER 17 - TWSC - UNSIGNALIZED INTERSECTIONS WORKSHEET

Analysis Summary

General Information

Analyst	WY	Jurisdiction/Date	1/21/05
Agency or Company	M&E	Major Street	HARDY ST
Analysis Period/Year	2015 PM AMB1	Minor Street	BIG SAVE DRIVEWAY
Comment	2015 AMBIENT PM PK HR FORECAST		

Input Data

Lane Configuration	EB	WB	NB	SB
Lane 1 (curb)	TR	LT	LR	
Lane 2				
Lane 3				

	EB			WB			NB			SB		
Movement	1 (LT)	2 (TH)	3 (RT)	4 (LT)	5 (TH)	6 (RT)	7 (LT)	8 (TH)	9 (RT)	10 (LT)	11 (TH)	12 (RT)
Volume (veh/h)		405	60	50	350		50		100			
PHF		.9	.9	.9	.9		.9		.9			
Proportion of heavy vehicles, HV		3	3	3	3		3		3			
Flow rate		450	67	56	389		56		111			
Flare storage (# of vehs)									0			
Median storage (# of vehs)							0					

Signal upstream of Movement 2 _____ ft Movement 5 _____ ft

Length of study period (h) .25

Output Data

	Lane	Movement	Flow Rate (veh/h)	Capacity (veh/h)	v/c	Queue Length (veh)	Control Delay (s)	LOS	Approach Delay and LOS
NB	1	LR	167	411	.406	2	19.6	C	19.6
	2								
	3								C
SB	1								
	2								
	3								
		①							
		④	56	1044	.053	<1	8.6	A	

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CHAPTER 17 - TWSC - UNSIGNALIZED INTERSECTIONS WORKSHEET

Analysis Summary

General Information

Analyst	WY	Jurisdiction/Date	1/21/05
Agency or Company	M&E	Major Street	HARDY ST
Analysis Period/Year	2015 PM AMB2	Minor Street	BIG SAVE DRIVEWAY
Comment	2015 AMB PM FC W/ KUHIO-HARDY SIGNA		

Input Data

Lane Configuration	EB	WB	NB	SB
Lane 1 (curb)	TR	LT	LR	
Lane 2				
Lane 3				

	EB			WB			NB			SB		
Movement	1 (LT)	2 (TH)	3 (RT)	4 (LT)	5 (TH)	6 (RT)	7 (LT)	8 (TH)	9 (RT)	10 (LT)	11 (TH)	12 (RT)
Volume (veh/h)		465	60	50	405		50		100			
PHF		.9	.9	.9	.9		.9		.9			
Proportion of heavy vehicles, HV		3	3	3	3		3		3			
Flow rate		517	67	56	450		56		111			
Flare storage (# of vehs)									0			
Median storage (# of vehs)							0					

Signal upstream of Movement 2 _____ ft Movement 5 _____ ft

Length of study period (h) .25

Output Data

	Lane	Movement	Flow Rate (veh/h)	Capacity (veh/h)	v/c	Queue Length (veh)	Control Delay (s)	LOS	Approach Delay and LOS
NB	1	LR	167	358	.466	2	23.5	C	23.5
	2								
	3								C
SB	1								
	2								
	3								
		①							
		④	56	986	.056	<1	8.9	A	

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CHAPTER 17 - TWSC - UNSIGNALIZED INTERSECTIONS WORKSHEET

Analysis Summary

General Information

Analyst	WY	Jurisdiction/Date	1/21/05
Agency or Company	M&E	Major Street	HARDY ST
Analysis Period/Year	2015 PM RE	Minor Street	BIG SAVE DRIVEWAY
Comment	2015 RECOMMENDED PM PK HR FORECAST		

Input Data

Lane Configuration	EB			WB			NB			SB		
Lane 1 (curb)	TR			LT			LR					
Lane 2												
Lane 3												
	EB			WB			NB			SB		
Movement	1 (LT)	2 (TH)	3 (RT)	4 (LT)	5 (TH)	6 (RT)	7 (LT)	8 (TH)	9 (RT)	10 (LT)	11 (TH)	12 (RT)
Volume (veh/h)		595	65	0	555				35			
PHF		.9	.9	.9	.9		.9		.9			
Proportion of heavy vehicles, HV		3	3	3	3		3		3			
Flow rate		661	72	0	617		0		39			
Flare storage (# of vehs)									0			
Median storage (# of vehs)							0					

Signal upstream of Movement 2 _____ ft Movement 5 _____ ft

Length of study period (h) .25

Output Data

	Lane	Movement	Flow Rate (veh/h)	Capacity (veh/h)	v/c	Queue Length (veh)	Control Delay (s)	LOS	Approach Delay and LOS
NB	1	LR	39	439	.089	<1	14	B	14
	2								
	3								B
SB	1								
	2								
	3								
		①							
		④	0						

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CHAPTER 17 - TWSC - UNSIGNALIZED INTERSECTIONS WORKSHEET

Analysis Summary

General Information

Analyst	WY	Jurisdiction/Date	1/21/05
Agency or Company	M&E	Major Street	HARDY ST
Analysis Period/Year	PM RE W/LT 2015	Minor Street	BIG SAVE DRIVEWAY
Comment	2015 REC PM FC W/ LT'S PERMITTED		

Input Data

Lane Configuration	EB			WB			NB			SB		
Lane 1 (curb)	TR			LT			LR					
Lane 2												
Lane 3												
	EB			WB			NB			SB		
Movement	1 (LT)	2 (TH)	3 (RT)	4 (LT)	5 (TH)	6 (RT)	7 (LT)	8 (TH)	9 (RT)	10 (LT)	11 (TH)	12 (RT)
Volume (veh/h)		595	65	50	555		50		35			
PHF		.9	.9	.9	.9		.9		.9			
Proportion of heavy vehicles, HV		3	3	3	3		3		3			
Flow rate		661	72	56	617		56		39			
Flare storage (# of vehs)									0			
Median storage (# of vehs)							0					

Signal upstream of Movement 2 _____ ft Movement 5 _____ ft

Length of study period (h) .25

Output Data

	Lane	Movement	Flow Rate (veh/h)	Capacity (veh/h)	v/c	Queue Length (veh)	Control Delay (s)	LOS	Approach Delay and LOS
NB	1	LR	95	193	.491	2	40.4	E	40.4
	2								
	3								E
SB	1								
	2								
	3								
		①							
		④	56	867	.064	<1	9.4	A	

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HARDY STREET/AKAHI STREET/COUNTY DRIVEWAY

CHAPTER 17 - TWSC - UNSIGNALIZED INTERSECTIONS WORKSHEET

Analysis Summary

General Information

Analyst	WY	Jurisdiction/Date	1/24/05
Agency or Company		Major Street	HARDY ST
Analysis Period/Year	2003 AMEX	Minor Street	AKAHI ST
Comment	2003 EXISTING AM PEAK HR		

Input Data

Lane Configuration	EB			WB			NB			SB		
Lane 1 (curb)		LT			TR						LR	
Lane 2												
Lane 3												
	EB			WB			NB			SB		
Movement	1 (LT)	2 (TH)	3 (RT)	4 (LT)	5 (TH)	6 (RT)	7 (LT)	8 (TH)	9 (RT)	10 (LT)	11 (TH)	12 (RT)
Volume (veh/h)	45	500			230	45				70		65
PHF	.85	.85			.85	.85				.85		.85
Proportion of heavy vehicles, HV	3	3			3	3				3		3
Flow rate	53	588			271	53				82		76
Flare storage (# of vehs)												0
Median storage (# of vehs)										0		

Signal upstream of Movement 2 _____ ft Movement 5 _____ ft

Length of study period (h) .25

Output Data

	Lane	Movement	Flow Rate (veh/h)	Capacity (veh/h)	v/c	Queue Length (veh)	Control Delay (s)	LOS	Approach Delay and LOS
NB	1								
	2								
	3								
SB	1	LR	76	740	.103	<1	10.4	B	10.4
	2								
	3								B
		①	53	1231	.043	<1	8.1	A	
		④							

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CHAPTER 17 - TWSC - UNSIGNALIZED INTERSECTIONS WORKSHEET

Analysis Summary —

General Information

Analyst	WY	Jurisdiction/Date	1/21/05
Agency or Company		Major Street	HARDY ST
Analysis Period/Year	2015 AM AMB1	Minor Street	AKAHI ST
Comment	2015 AMBIENT AM PK HR FORECAST		

Input Data

Lane Configuration	EB			WB			NB			SB		
Lane 1 (curb)		LT			TR						LR	
Lane 2												
Lane 3												
	EB			WB			NB			SB		
Movement	1 (LT)	2 (TH)	3 (RT)	4 (LT)	5 (TH)	6 (RT)	7 (LT)	8 (TH)	9 (RT)	10 (LT)	11 (TH)	12 (RT)
Volume (veh/h)	55	590			265	55				85		75
PHF	.85	.85			.85	.85				.85		.85
Proportion of heavy vehicles, HV	3	3			3	3				3		3
Flow rate	65	694			312	65				100		88
Flare storage (# of vehs)												0
Median storage (# of vehs)										0		

Signal upstream of Movement 2 _____ ft Movement 5 _____ ft

Length of study period (h) .25

Output Data

	Lane	Movement	Flow Rate (veh/h)	Capacity (veh/h)	v/c	Queue Length (veh)	Control Delay (s)	LOS	Approach Delay and LOS
NB	1								
	2								
	3								
SB	1	LR	173	315	.549	3	29.5	D	29.5
	2								
	3								D
		①	65	1177	.055	<1	8.2	A	
		④							

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CHAPTER 17 - TWSC - UNSIGNALIZED INTERSECTIONS WORKSHEET

Analysis Summary

General Information

Analyst	WY	Jurisdiction/Date	1/24/05
Agency or Company		Major Street	HARDY ST
Analysis Period/Year	2015 AM AMB2	Minor Street	AKAHI ST
Comment	2015 AMB AM FC W/KUHIO-HARDY SIGNAL		

Input Data

Lane Configuration	EB			WB			NB			SB		
Lane 1 (curb)	LT			TR						LR		
Lane 2												
Lane 3												
	EB			WB			NB			SB		
Movement	1 (LT)	2 (TH)	3 (RT)	4 (LT)	5 (TH)	6 (RT)	7 (LT)	8 (TH)	9 (RT)	10 (LT)	11 (TH)	12 (RT)
Volume (veh/h)	55	650			380	55				85		75
PHF	.85	.85			.85	.85				.85		.85
Proportion of heavy vehicles, HV	3	3			3	3				3		3
Flow rate	65	765			447	65				100		88
Flare storage (# of vehs)												0
Median storage (# of vehs)										0		

Signal upstream of Movement 2 _____ ft Movement 5 _____ ft

Length of study period (h) .25

Output Data

	Lane	Movement	Flow Rate (veh/h)	Capacity (veh/h)	v/c	Queue Length (veh)	Control Delay (s)	LOS	Approach Delay and LOS
NB	1								
	2								
	3								
SB	1	LR	173	241	.718	5	50.5	F	50.5
	2								
	3								F
		①	65	1048	.062	<1	8.7	A	
		④							

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CHAPTER 17 - TWSC - UNSIGNALIZED INTERSECTIONS WORKSHEET

Analysis Summary

General Information

Analyst	WY	Jurisdiction/Date	1/10/05
Agency or Company	M&E	Major Street	HARDY ST
Analysis Period/Year	2015 AMRE	Minor Street	AKAHI ST
Comment	2015 RECMNDED AM PEAK HR		

Input Data

Lane Configuration	EB			WB			NB			SB		
Lane 1 (curb)	LTR			LTR			TR			LTR		
Lane 2							L					
Lane 3												
	EB			WB			NB			SB		
Movement	1 (LT)	2 (TH)	3 (RT)	4 (LT)	5 (TH)	6 (RT)	7 (LT)	8 (TH)	9 (RT)	10 (LT)	11 (TH)	12 (RT)
Volume (veh/h)	45	550	55	95	265	45	65	10	30	75	15	60
PHF	.9	.9	.9	.9	.9	.9	.9	.9	.9	.9	.9	.9
Proportion of heavy vehicles, HV	3	3	3	3	3	3	3	3	3	3	3	3
Flow rate	50	611	61	106	294	50	72	11	33	83	17	67
Flare storage (# of vehs)									0			0
Median storage (# of vehs)							0			0		

Signal upstream of Movement 2 _____ ft Movement 5 _____ ft

Length of study period (h) .25

Output Data

	Lane	Movement	Flow Rate (veh/h)	Capacity (veh/h)	v/c	Queue Length (veh)	Control Delay (s)	LOS	Approach Delay and LOS
NB	1	TR	44	285	.155	1	19.9	C	69.8
	2	L	65	94	.692	3	103.5	F	
	3								F
SB	1	LTR	148	172	.86	6	89.6	F	89.6
	2								
	3								F
		①	50	1209	.041	<1	8.1	A	
		④	106	914	.116	<1	9.5	A	

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CHAPTER 17 - TWSC - UNSIGNALIZED INTERSECTIONS WORKSHEET

Analysis Summary

General Information

Analyst	WY	Jurisdiction/Date	1/15/05
Agency or Company	M&E	Major Street	HARDY ST
Analysis Period/Year	2015 AMRE2	Minor Street	AKAHI ST
Comment	2015 RECMNDED AM PEAK HR W/ LT		

Input Data

Lane Configuration	EB			WB			NB			SB		
Lane 1 (curb)		TR			TR			TR			LTR	
Lane 2		L			L			L				
Lane 3												
	EB			WB			NB			SB		
Movement	1 (LT)	2 (TH)	3 (RT)	4 (LT)	5 (TH)	6 (RT)	7 (LT)	8 (TH)	9 (RT)	10 (LT)	11 (TH)	12 (RT)
Volume (veh/h)	45	550	55	95	265	45	65	10	30	75	15	60
PHF	.9	.9	.9	.9	.9	.9	.9	.9	.9	.9	.9	.9
Proportion of heavy vehicles, HV	3	3	3	3	3	3	3	3	3	3	3	3
Flow rate	50	611	61	106	294	50	72	11	33	83	17	67
Flare storage (# of vehs)									0			0
Median storage (# of vehs)							0			0		

Signal upstream of Movement 2 _____ ft Movement 5 _____ ft

Length of study period (h) .25

Output Data

	Lane	Movement	Flow Rate (veh/h)	Capacity (veh/h)	v/c	Queue Length (veh)	Control Delay (s)	LOS	Approach Delay and LOS
NB	1	TR	44	293	.15	1	19.5	C	64.8
	2	L	65	98	.664	3	95.4	F	
	3								F
SB	1	LTR	153	183	.836	6	81.3	F	81.3
	2								
	3								F
		①	50	1209	.041	<1	8.1	A	
		④	106	914	.116	<1	9.5	A	

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CHAPTER 17 - AWSC - UNSIGNALIZED INTERSECTIONS WORKSHEET

Analysis Summary

General Information

Analyst	WY	Jurisdiction/Date	1/15/05
Agency or Company	M&E	EB-WB Street	HARDY STREET
Analysis Period/Year	AMRE4WAY 2015	NB-SB Street	AKAHI STREET
Comment	2015 AM REC W/4WAY STOP		

Input Data

		EB		WB		NB		SB	
		Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2
Lane code (Lane 1 is curb lane)		LTR		LTR		LTR		LTR	
Volume (veh/h)	Left-turn	45		95		65		75	
	Through	550		265		10		15	
	Right-turn	55		45		30		60	
Peak-hour factor		.9		.9		.9		.9	
% Heavy vehicles		3		3		3		3	

Outputs

	EB		WB		NB		SB	
	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2
Total lane flow rate (veh/h)	722		450		117		167	
Departure headway, h_d (s)	5.85		6.06		7.44		7.15	
Degree of utilization, x	1.174		.758		.241		.331	
Move-up time, m (s)	2		2		2		2	
Service time, t_s (s)	3.85		4.06		5.44		5.15	
Capacity (veh/h)	610		586		444		470	
Delay (s) (Equation 17-55)	115.9		25.6		12.8		13.6	
Level of service (Exhibit 17-22)	F		D		B		B	
Delay (s), approach	115.9		25.6		12.8		13.6	
Level of service, approach	F		D		B		B	
Delay (s), intersection	68							
Level of service, intersection	F							

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CHAPTER 17 - AWSC - UNSIGNALIZED INTERSECTIONS WORKSHEET

Analysis Summary

General Information

Analyst	WY	Jurisdiction/Date	1/15/05
Agency or Company	M&E	EB-WB Street	HARDY STREET
Analysis Period/Year	AMRB4WAY LT 2015	NB-SB Street	AKAHI STREET
Comment	2015 AM REC W/4WAY STOP & LT LANES		

Input Data

		EB		WB		NB		SB	
		Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2
Lane code (Lane 1 is curb lane)		TR	L	TR	L	TR	L	LTR	
Volume (veh/h)	Left-turn		45		95		65	75	
	Through	550		265		10		15	
	Right-turn	55		45		30		60	
Peak-hour factor		.9	.9	.9	.9	.9	.9	.9	
% Heavy vehicles		3	3	3	3	3	3	3	

Outputs

	EB		WB		NB		SB	
	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2
Total lane flow rate (veh/h)	672	50	344	106	44	72	167	
Departure headway, h_d (s)	6.13	6.7	6.29	6.88	7.2	8.21	6.12	
Degree of utilization, x	1.144	.093	.601	.202	.089	.165	.283	
Move-up time, m (s)	2.3	2.3	2.3	2.3	2.3	2.3	2.3	
Service time, t_s (s)	3.83	4.4	3.99	4.58	4.9	5.91	3.82	
Capacity (veh/h)	587	556	574	546	488	427	669	
Delay (s) (Equation 17-55)	106	10.1	18	11.3	10.6	12.5	11.2	
Level of service (Exhibit 17-22)	F	B	C	B	B	B	B	
Delay (s), approach	99.4		16.4		11.8		11.2	
Level of service, approach	F		C		B		B	
Delay (s), intersection	56.6							
Level of service, intersection	F							

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CHAPTER 16 - OPERATIONAL ANALYSIS - SUMMARY WORKSHEET

General Information

Analyst	WY	Jurisdiction/Date	1/15/05
Agency or Company	M&E PAC	EB/WB Street	HARDY ST
Analysis Period/Year	2015 AM20RE	NB/SB Street	AKAHI ST/C
Comment	2015 RECPLAN 20% AM PK HR W/2LANE		

Intersection Data

Area type Other Analysis period .25 h Signal type Actuated-Field % Back of queue 95

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Volume (veh/h)	50	585	55	95	280	50	65	10	30	75	15	60
RTOR volume (veh/h)			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	1	1	1	1	1	1
Start-up lost time, l_1 (s)	2	2	2	2	2	2	2	2	2	2	2	2
Extension of effective green, e (s)	2	2	2	2	2	2	2	2	2	2	2	2
Arrival type, AT	3	3	3	3	3	3	3	3	3	3	3	3
Approach pedestrian volume (p/h)	50			50			50			50		
Approach bicycle volume (bic/h)	0			0			0			0		
Left/right parking (Y or N)	N / N			N / N			N / N			N / N		

Signal Phasing Plan

L: LT T: TH R: RT P: Peds

	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Phase 6	Phase 7	Phase 8
EB	LTRP							
WB	LTRP							
NB		LTRP						
SB		LTRP						
Green (s)	40	20						
Yellow + All red (s)	5	5						

Cycle (s) 70 Lost time per cycle (s) 10 Critical v/c Ratio .651

Intersection Performance

	EB	WB	NB		SB
Lane group configuration	LTR	LTR	L	TR	LTR
No. of lanes	1	1	1	1	1
Flow rate (veh/h)	750	462	71	43	163
Capacity (veh/h)	979	779	330	442	388
Adjusted saturation flow (veh/h)	1714	1364	1155	1548	1359
v/c ratio	.766	.593	.214	.098	.42
g/C ratio	.571	.571	.286	.286	.286
Average back of queue (veh)	12.9	6.6	1.1	.7	2.8
Uniform delay (s)	11.4	9.7	19	18.4	20.3
Incremental delay (s)	3.7	1.2	0	0	.3
Initial queue delay (s)	0	0	0	0	0
Delay (s)	15.1	10.9	19	18.4	20.6
LOS	B	B	B	B	C
Approach delay (s)/LOS	15.1 / B	10.9 / B	18.8 / B		20.6 / C
Intersection delay (s)/ LOS	14.7 / B				

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CHAPTER 16 - OPERATIONAL ANALYSIS - SUMMARY WORKSHEET

General Information

Analyst: WY
Agency or Company: M&E PAC
Analysis Period/Year: AM20RE 2015
Comment: 2015 RECPLAN 20% AM PK HR W/LT LANE

Site Information

Jurisdiction/Date: 1/15/05
EB/WB Street: HARDY ST
NB/SB Street: AKAHI ST/C

Intersection Data

Area type: Other | Analysis period: .25 h | Signal type: Actuated-Field | % Back of queue: 95

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Volume (veh/h)	50	585	55	95	280	50	65	10	30	75	15	60
RTOR volume (veh/h)			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	1	1	1	1	1	1
Start-up lost time, l_1 (s)	2	2	2	2	2	2	2	2	2	2	2	2
Extension of effective green, e (s)	2	2	2	2	2	2	2	2	2	2	2	2
Arrival type, AT	3	3	3	3	3	3	3	3	3	3	3	3
Approach pedestrian volume (p/h)	50			50			50			50		
Approach bicycle volume (bic/h)	0			0			0			0		
Left/right parking (Y or N)	N	/	N	N	/	N	N	/	N	N	/	N

Signal Phasing Plan

L: LT T: TH R: RT P: Peds

	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Phase 6	Phase 7	Phase 8
EB	LTRP							
WB	LTRP							
NB		LTRP						
SB		LTRP						
Green (s)	40	20						
Yellow + All red (s)	5	5						

Cycle (s): 70 | Lost time per cycle (s): 10 | Critical v/c Ratio: .587

Intersection Performance

	EB			WB			NB			SB		
Lane group configuration	L	TR		L	TR		L	TR			LTR	
No. of lanes	1	1		1	1		1	1			1	
Flow rate (veh/h)	54	696		103	359		71	43			163	
Capacity (veh/h)	532	1039		274	1025		330	442			388	
Adjusted saturation flow (veh/h)	931	1818		480	1794		1155	1548			1359	
v/c ratio	.102	.67		.376	.35		.214	.098			.42	
g/C ratio	.571	.571		.571	.571		.286	.286			.286	
Average back of queue (veh)	.5	10.6		1.3	4.1		1.1	.7			2.8	
Uniform delay (s)	6.8	10.4		8.2	8		19	18.4			20.3	
Incremental delay (s)	0	1.7		.1	0		0	0			.3	
Initial queue delay (s)	0	0		0	0		0	0			0	
Delay (s)	6.8	12.1		8.3	8		19	18.4			20.6	
LOS	A	B		A	A		B	B			C	
Approach delay (s)/LOS	11.7	/	B	8.1	/	A	18.8	/	B	20.6	/	C
Intersection delay (s)/ LOS	12.1	/	B									

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CHAPTER 17 - TWSC - UNSIGNALIZED INTERSECTIONS WORKSHEET

Analysis Summary

General Information

Analyst: WY
Agency or Company:
Analysis Period/Year: 2003 PMEX
Comment: 2003 EXISTING PM PEAK HR

Site Information

Jurisdiction/Date: 10/28/03
Major Street: HARDY ST
Minor Street: AKAHI ST

Input Data

Lane Configuration	EB			WB			NB			SB		
Lane 1 (curb)	LT			TR						LR		
Lane 2												
Lane 3												
	EB			WB			NB			SB		
Movement	1 (LT)	2 (TH)	3 (RT)	4 (LT)	5 (TH)	6 (RT)	7 (LT)	8 (TH)	9 (RT)	10 (LT)	11 (TH)	12 (RT)
Volume (veh/h)	30	405			290	45				125		50
PHF	.85	.85			.85	.85				.85		.85
Proportion of heavy vehicles, HV	3	3			3	3				3		3
Flow rate	35	476			341	53				147		59
Flare storage (# of vehs)												0
Median storage (# of vehs)										0		

Signal upstream of Movement 2: ft | Movement 5: ft
Length of study period (h): .25

Output Data

	Lane	Movement	Flow Rate (veh/h)	Capacity (veh/h)	v/c	Queue Length (veh)	Control Delay (s)	LOS	Approach Delay and LOS
NB	1								
	2								
	3								
SB	1	LR	59	676	.087	<1	10.8	B	10.8
	2								
	3								B
		①	35	1159	.03	<1	8.2	A	
		④							

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CHAPTER 17 - TWSC - UNSIGNALIZED INTERSECTIONS WORKSHEET

Analysis Summary

General Information

Analyst	WY	Jurisdiction/Date	1/21/05
Agency or Company	M&E	Major Street	HARDY ST
Analysis Period/Year	2015 PM AMB1	Minor Street	AKAHI ST
Comment	2015 AMBIENT PM PK HR FORECAST		

Input Data

Lane Configuration	EB			WB			NB			SB		
Lane 1 (curb)	LT			TR						LR		
Lane 2												
Lane 3												
	EB			WB			NB			SB		
Movement	1 (LT)	2 (TH)	3 (RT)	4 (LT)	5 (TH)	6 (RT)	7 (LT)	8 (TH)	9 (RT)	10 (LT)	11 (TH)	12 (RT)
Volume (veh/h)	35	490			305	50				150		60
PHF	.85	.85			.85	.85				.85		.85
Proportion of heavy vehicles, HV	3	3			3	3				3		3
Flow rate	41	576			359	59				176		71
Flare storage (# of vehs)												0
Median storage (# of vehs)										0		

Signal upstream of Movement 2 _____ ft Movement 5 _____ ft

Length of study period (h) .25

Output Data

	Lane	Movement	Flow Rate (veh/h)	Capacity (veh/h)	v/c	Queue Length (veh)	Control Delay (s)	LOS	Approach Delay and LOS
NB	1								
	2								
	3								
SB	1	LR	247	296	.834	7	57	F	57
	2								
	3								F
		①	41	1136	.036	<1	8.3	A	
		④							

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CHAPTER 17 - TWSC - UNSIGNALIZED INTERSECTIONS WORKSHEET

Analysis Summary

General Information

Analyst	WY	Jurisdiction/Date	1/21/05
Agency or Company	M&E	Major Street	HARDY ST
Analysis Period/Year	2015 PM AMB2	Minor Street	AKAHI ST
Comment	2015 AMB PM FC W/KUHIO-HARDY SIGNAL		

Input Data

Lane Configuration	EB			WB			NB			SB		
Lane 1 (curb)	LT			TR						LR		
Lane 2												
Lane 3												
	EB			WB			NB			SB		
Movement	1 (LT)	2 (TH)	3 (RT)	4 (LT)	5 (TH)	6 (RT)	7 (LT)	8 (TH)	9 (RT)	10 (LT)	11 (TH)	12 (RT)
Volume (veh/h)	35	550			305	50				150		60
PHF	.85	.85			.85	.85				.85		.85
Proportion of heavy vehicles, HV	3	3			3	3				3		3
Flow rate	41	647			359	59				176		71
Flare storage (# of vehs)												0
Median storage (# of vehs)										0		

Signal upstream of Movement 2 _____ ft Movement 5 _____ ft

Length of study period (h) .25

Output Data

	Lane	Movement	Flow Rate (veh/h)	Capacity (veh/h)	v/c	Queue Length (veh)	Control Delay (s)	LOS	Approach Delay and LOS
NB	1								
	2								
	3								
SB	1	LR	247	272	.908	8	74	F	74
	2								
	3								F
		①	41	1136	.036	<1	8.3	A	
		④							

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CHAPTER 17 - TWSC - UNSIGNALIZED INTERSECTIONS WORKSHEET

Analysis Summary

General Information

Analyst	WY	Jurisdiction/Date	1/15/05
Agency or Company	M&E	Major Street	HARDY ST
Analysis Period/Year	2015 PMRE	Minor Street	AKAHI ST
Comment	2015 RECMNDED PM PEAK HR		

Site Information

Input Data

Lane Configuration	EB			WB			NB			SB		
Lane 1 (curb)	LTR			LTR			TR			LTR		
Lane 2							L					
Lane 3												
	EB			WB			NB			SB		
Movement	1 (LT)	2 (TH)	3 (RT)	4 (LT)	5 (TH)	6 (RT)	7 (LT)	8 (TH)	9 (RT)	10 (LT)	11 (TH)	12 (RT)
Volume (veh/h)	45	530	30	70	275	45	225	10	45	145	10	55
PHF	.9	.9	.9	.9	.9	.9	.9	.9	.9	.9	.9	.9
Proportion of heavy vehicles, HV	3	3	3	3	3	3	1	1	1	1	1	1
Flow rate	50	589	33	78	306	50	250	11	50	161	11	61
Flare storage (# of vehs)									0			0
Median storage (# of vehs)							0			0		

Signal upstream of Movement 2 _____ ft Movement 5 _____ ft

Length of study period (h) .25

Output Data

	Lane	Movement	Flow Rate (veh/h)	Capacity (veh/h)	v/c	Queue Length (veh)	Control Delay (s)	LOS	Approach Delay and LOS
NB	1	TR	56	346	.162	1	17.4	C	481.2
	2	L	250	119	2.106	21	585.1	F	
	3								F
SB	1	LTR	233	153	1.523	16	319.3	F	319.3
	2								
	3								F
		①	50	1198	.042	<1	8.1	A	
		④	78	954	.082	<1	9.1	A	

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CHAPTER 17 - TWSC - UNSIGNALIZED INTERSECTIONS WORKSHEET

Analysis Summary

General Information

Analyst	WY	Jurisdiction/Date	1/15/05
Agency or Company	M&E	Major Street	HARDY ST
Analysis Period/Year	2015 PMRE2	Minor Street	AKAHI ST
Comment	2015 RCMND PM PK HR W/ LT LANE		

Site Information

Input Data

Lane Configuration	EB			WB			NB			SB		
Lane 1 (curb)	TR			TR			TR			LTR		
Lane 2	L			L			L					
Lane 3												
	EB			WB			NB			SB		
Movement	1 (LT)	2 (TH)	3 (RT)	4 (LT)	5 (TH)	6 (RT)	7 (LT)	8 (TH)	9 (RT)	10 (LT)	11 (TH)	12 (RT)
Volume (veh/h)	45	530	30	70	275	45	225	10	45	145	10	55
PHF	.85	.9	.9	.9	.85	.85	.9	.9	.9	.9	.9	.9
Proportion of heavy vehicles, HV	1	3	1	1	1	1	1	1	1	1	1	1
Flow rate	53	589	33	78	324	53	250	11	50	161	11	61
Flare storage (# of vehs)									0			0
Median storage (# of vehs)							0			0		

Signal upstream of Movement 2 _____ ft Movement 5 _____ ft

Length of study period (h) .25

Output Data

	Lane	Movement	Flow Rate (veh/h)	Capacity (veh/h)	v/c	Queue Length (veh)	Control Delay (s)	LOS	Approach Delay and LOS
NB	1	TR	61	355	.172	1	17.2	C	402.4
	2	L	225	117	1.921	18	506.8	F	
	3								F
SB	1	LTR	233	151	1.541	16	327.4	F	327.4
	2								
	3								F
		①	53	1188	.045	<1	8.2	A	
		④	78	964	.081	<1	9.1	A	

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CHAPTER 17 - AWSC - UNSIGNALIZED INTERSECTIONS WORKSHEET

Analysis Summary

General Information

Analyst	WY	Jurisdiction/Date	1/15/05
Agency or Company	M&E	EB-WB Street	HARDY ST
Analysis Period/Year	PMRE4WAY 2015	NB-SB Street	AKAHI ST
Comment	2105 PM REC W/4 WAY STOP		

Input Data

		EB		WB		NB		SB	
		Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2
Lane code (Lane 1 is curb lane)		LTR		LTR		LTR		LTR	
Volume (veh/h)	Left-turn	45		70		225		145	
	Through	530		275		10		10	
	Right-turn	30		45		45		55	
Peak-hour factor		.9		.9		.9		.9	
% Heavy vehicles		3		3		3		3	

Outputs

	EB		WB		NB		SB	
	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2
Total lane flow rate (veh/h)	672		433		311		233	
Departure headway, h_d (s)	7.9		7.84		8.47		8.8	
Degree of utilization, x	1.476		.944		.732		.57	
Move-up time, m (s)	2		2		2		2	
Service time, t_s (s)	5.9		5.84		6.47		6.8	
Capacity (veh/h)	445		456		414		393	
Delay (s) (Equation 17-55)	247.2		57.3		31.3		22.8	
Level of service (Exhibit 17-22)	F		F		D		C	
Delay (s), approach	247.2		57.3		31.3		22.8	
Level of service, approach	F		F		D		C	
Delay (s), intersection	124.9							
Level of service, intersection	F							

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CHAPTER 17 - AWSC - UNSIGNALIZED INTERSECTIONS WORKSHEET

Analysis Summary

General Information

Analyst	WY	Jurisdiction/Date	1/15/05
Agency or Company	M&E	EB-WB Street	HARDY WT
Analysis Period/Year	PMRE4WAY LT 2015	NB-SB Street	AKAHI ST
Comment	2015 PM REC W/4WAY STOP & LT LANES		

Input Data

		EB		WB		NB		SB	
		Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2
Lane code (Lane 1 is curb lane)		TR	L	TR	L	TR	L	LTR	
Volume (veh/h)	Left-turn		45		70		225	145	
	Through	530		275		10		10	
	Right-turn	30		45		45		55	
Peak-hour factor		.9	.9	.9	.9	.9	.9	.9	
% Heavy vehicles		3	3	3	3	3	3	3	

Outputs

	EB		WB		NB		SB	
	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2
Total lane flow rate (veh/h)	622	50	356	78	61	250	233	
Departure headway, h_d (s)	7.47	8.02	7.57	8.17	7.55	8.6	6.6	
Degree of utilization, x	1.29	.111	.748	.176	.128	.598	.428	
Move-up time, m (s)	2.3	2.3	2.3	2.3	2.3	2.3	2.3	
Service time, t_s (s)	5.17	5.72	5.27	5.87	5.25	6.3	4.3	
Capacity (veh/h)	480	474	475	466	497	414	622	
Delay (s) (Equation 17-55)	168.3	11.7	29.5	12.6	11.4	23.3	14.1	
Level of service (Exhibit 17-22)	F	B	D	B	B	C	B	
Delay (s), approach	156.6		26.4		20.9		14.1	
Level of service, approach	F		D		C		B	
Delay (s), intersection	76.7							
Level of service, intersection	F							

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CHAPTER 16 - OPERATIONAL ANALYSIS - SUMMARY WORKSHEET

General Information

Analyst: WY
Agency or Company: M&E PAC
Analysis Period/Year: 2015 PMRE
Comment: 2015 RECPLAN PM PK HR W/2LANE

Site Information

Jurisdiction/Date: 1/15/05
EB/WB Street: HARDY ST
NB/SB Street: AKAHI ST/C

Intersection Data

Area type: Other Analysis period: .25 h Signal type: Actuated-Field % Back of queue: 95

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Volume (veh/h)	45	530	30	70	275	45	225	10	45	145	10	55
RTOR volume (veh/h)			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	1	1	1	1	1	1
Start-up lost time, l_1 (s)	2	2	2	2	2	2	2	2	2	2	2	2
Extension of effective green, e (s)	2	2	2	2	2	2	2	2	2	2	2	2
Arrival type, AT	3	3	3	3	3	3	3	3	3	3	3	3
Approach pedestrian volume (p/h)	50			50			50			50		
Approach bicycle volume (bic/h)	0			0			0			0		
Left/right parking (Y or N)	N	/	N	N	/	N	N	/	N	N	/	N

Signal Phasing Plan

L: LT T: TH R: RT P: Peds

	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Phase 6	Phase 7	Phase 8
EB	LTRP							
WB	LTRP							
NB		LTRP						
SB		LTRP						
Green (s)	40	20						
Yellow + All red (s)	5	5						

Cycle (s): 70 Lost time per cycle (s): 10 Critical v/c Ratio: .693

Intersection Performance

	EB	WB	NB		SB
Lane group configuration	LTR	LTR	L	TR	LTR
No. of lanes	1	1	1	1	1
Flow rate (veh/h)	658	424	245	60	228
Capacity (veh/h)	989	846	327	434	359
Adjusted saturation flow (veh/h)	1731	1481	1145	1520	1257
v/c ratio	.665	.501	.748	.138	.636
g/C ratio	.571	.571	.286	.286	.286
Average back of queue (veh)	10	5.5	5.2	.9	4.4
Uniform delay (s)	10.4	9	22.7	18.6	21.8
Incremental delay (s)	1.7	.5	9.2	0	3.7
Initial queue delay (s)	0	0	0	0	0
Delay (s)	12.1	9.5	31.9	18.6	25.5
LOS	B	A	C	B	C
Approach delay (s)/LOS	12.1 / B	9.5 / A	29.3 / C		25.5 / C
Intersection delay (s)/ LOS	16.5 / B				

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CHAPTER 16 - OPERATIONAL ANALYSIS - SUMMARY WORKSHEET

General Information

Analyst: WY
Agency or Company: M&E PAC
Analysis Period/Year: 2015 PMRE LT
Comment: 2015 RECPLAN PM PK HR W/LT LANE

Site Information

Jurisdiction/Date: 1/15/05
EB/WB Street: HARDY ST
NB/SB Street: AKAHI ST/C

Intersection Data

Area type: Other Analysis period: .25 h Signal type: Actuated-Field % Back of queue: 95

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Volume (veh/h)	45	530	30	70	275	45	225	10	45	145	10	55
RTOR volume (veh/h)			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	1	1	1	1	1	1
Start-up lost time, l_1 (s)	2	2	2	2	2	2	2	2	2	2	2	2
Extension of effective green, e (s)	2	2	2	2	2	2	2	2	2	2	2	2
Arrival type, AT	3	3	3	3	3	3	3	3	3	3	3	3
Approach pedestrian volume (p/h)	50			50			50			50		
Approach bicycle volume (bic/h)	0			0			0			0		
Left/right parking (Y or N)	N	/	N	N	/	N	N	/	N	N	/	N

Signal Phasing Plan

L: LT T: TH R: RT P: Peds

	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Phase 6	Phase 7	Phase 8
EB	LTRP							
WB	LTRP							
NB		LTRP						
SB		LTRP						
Green (s)	40	20						
Yellow + All red (s)	5	5						

Cycle (s): 70 Lost time per cycle (s): 10 Critical v/c Ratio: .637

Intersection Performance

	EB		WB		NB		SB
Lane group configuration	L	TR	L	TR	L	TR	LTR
No. of lanes	1	1	1	1	1	1	1
Flow rate (veh/h)	49	609	76	348	245	60	228
Capacity (veh/h)	541	1045	337	1028	327	434	359
Adjusted saturation flow (veh/h)	947	1829	590	1798	1145	1520	1257
v/c ratio	.09	.582	.226	.339	.748	.138	.636
g/C ratio	.571	.571	.571	.571	.286	.286	.286
Average back of queue (veh)	.5	8.4	.8	3.9	5.2	.9	4.4
Uniform delay (s)	6.8	9.6	7.4	8	22.7	18.6	21.8
Incremental delay (s)	0	.8	0	0	9.2	0	3.7
Initial queue delay (s)	0	0	0	0	0	0	0
Delay (s)	6.8	10.4	7.4	8	31.9	18.6	25.5
LOS	A	B	A	A	C	B	C
Approach delay (s)/LOS	10.2 / B		7.9 / A		29.3 / C		25.5 / C
Intersection delay (s)/ LOS	15.3 / B						

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HARDY STREET/EIWA STREET

CHAPTER 17 - TWSC - UNSIGNALIZED INTERSECTIONS WORKSHEET

Analysis Summary

General Information

Analyst	WY	Jurisdiction/Date	10/28/03
Agency or Company		Major Street	HARDY ST
Analysis Period/Year	2003 AMEX	Minor Street	EIWA ST
Comment	2003 EXISTING AM PEAK HR		

Input Data

Lane Configuration	EB	WB	NB	SB
Lane 1 (curb)	TR	LT	LR	
Lane 2				
Lane 3				

	EB			WB			NB			SB		
Movement	1 (LT)	2 (TH)	3 (RT)	4 (LT)	5 (TH)	6 (RT)	7 (LT)	8 (TH)	9 (RT)	10 (LT)	11 (TH)	12 (RT)
Volume (veh/h)		495	85	165	220		65		110			
PHF		.9	.9	.9	.9		.9		.9			
Proportion of heavy vehicles, HV		3	3	3	3		3		3			
Flow rate		550	94	183	244		72		122			
Flare storage (# of vehs)									0			
Median storage (# of vehs)							0					

Signal upstream of Movement 2 _____ ft Movement 5 _____ ft

Length of study period (h) .25

Output Data

	Lane	Movement	Flow Rate (veh/h)	Capacity (veh/h)	v/c	Queue Length (veh)	Control Delay (s)	LOS	Approach Delay and LOS
NB	1	LR	122	501	.244	1	14.5	B	14.5
	2								
	3								B
SB	1								
	2								
	3								
		①							
		④	183	936	.196	1	9.8	A	

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CHAPTER 17 - TWSC - UNSIGNALIZED INTERSECTIONS WORKSHEET

Analysis Summary

General Information

Analyst	WY	Jurisdiction/Date	1/21/05
Agency or Company		Major Street	HARDY ST
Analysis Period/Year	2015 AM AMB1	Minor Street	EIWA ST
Comment	2015 AMBIENT AM PK HR FORECAST		

Input Data

Lane Configuration	EB	WB	NB	SB
Lane 1 (curb)	TR	LT	LR	
Lane 2				
Lane 3				

	EB			WB			NB			SB		
Movement	1 (LT)	2 (TH)	3 (RT)	4 (LT)	5 (TH)	6 (RT)	7 (LT)	8 (TH)	9 (RT)	10 (LT)	11 (TH)	12 (RT)
Volume (veh/h)		600	85	200	265		70		135			
PHF		.9	.9	.9	.9		.9		.9			
Proportion of heavy vehicles, HV		3	3	3	3		3		3			
Flow rate		667	94	222	294		78		150			
Flare storage (# of vehs)									0			
Median storage (# of vehs)							0					

Signal upstream of Movement 2 _____ ft Movement 5 _____ ft

Length of study period (h) .25

Output Data

	Lane	Movement	Flow Rate (veh/h)	Capacity (veh/h)	v/c	Queue Length (veh)	Control Delay (s)	LOS	Approach Delay and LOS
NB	1	LR	228	209	1.089	10	136.3	F	136.3
	2								
	3								F
SB	1								
	2								
	3								
		①							
		④	222	846	.263	1	10.8	B	

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CHAPTER 17 - TWSC - UNSIGNALIZED INTERSECTIONS WORKSHEET

Analysis Summary

General Information

Analyst	WY	Jurisdiction/Date	1/21/05
Agency or Company		Major Street	HARDY ST
Analysis Period/Year	2015 AM AMB2	Minor Street	EIWA ST
Comment	2015 AMB AM FC W/KUHIO-HARDY SIGNAL		

Input Data

Lane Configuration	EB			WB			NB			SB		
Lane 1 (curb)	TR			LT			LR					
Lane 2												
Lane 3												
	EB			WB			NB			SB		
Movement	1 (LT)	2 (TH)	3 (RT)	4 (LT)	5 (TH)	6 (RT)	7 (LT)	8 (TH)	9 (RT)	10 (LT)	11 (TH)	12 (RT)
Volume (veh/h)		660	45	130	340		70		135			
PHF		.9	.9	.9	.9		.9		.9			
Proportion of heavy vehicles, HV		3	3	3	3		3		3			
Flow rate		733	50	144	378		78		150			
Flare storage (# of vehs)									0			
Median storage (# of vehs)							0					

Signal upstream of Movement 2 _____ ft Movement 5 _____ ft

Length of study period (h) .25

Output Data

	Lane	Movement	Flow Rate (veh/h)	Capacity (veh/h)	v/c	Queue Length (veh)	Control Delay (s)	LOS	Approach Delay and LOS
NB	1	LR	228	227	1.006	9	106.9	F	106.9
	2								
	3								F
SB	1								
	2								
	3								
		①							
		④	144	830	.174	1	10.2	B	

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CHAPTER 17 - TWSC - UNSIGNALIZED INTERSECTIONS WORKSHEET

Analysis Summary

General Information

Analyst	WY	Jurisdiction/Date	10/28/03
Agency or Company		Major Street	HARDY ST
Analysis Period/Year	2003 PMEX	Minor Street	EIWA ST
Comment	2003 EXISTING PM PEAK HR		

Input Data

Lane Configuration	EB			WB			NB			SB		
Lane 1 (curb)	TR			LT			LR					
Lane 2												
Lane 3												
	EB			WB			NB			SB		
Movement	1 (LT)	2 (TH)	3 (RT)	4 (LT)	5 (TH)	6 (RT)	7 (LT)	8 (TH)	9 (RT)	10 (LT)	11 (TH)	12 (RT)
Volume (veh/h)		365	85	120	205		130		180			
PHF		.9	.9	.9	.9		.9		.9			
Proportion of heavy vehicles, HV		3	3	3	3		3		3			
Flow rate		406	94	133	228		144		200			
Flare storage (# of vehs)									0			
Median storage (# of vehs)							0					

Signal upstream of Movement 2 _____ ft Movement 5 _____ ft

Length of study period (h) .25

Output Data

	Lane	Movement	Flow Rate (veh/h)	Capacity (veh/h)	v/c	Queue Length (veh)	Control Delay (s)	LOS	Approach Delay and LOS
NB	1	LR	200	605	.331	1	13.9	B	13.9
	2								
	3								B
SB	1								
	2								
	3								
		①							
		④	133	1059	.126	<1	8.9	A	

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CHAPTER 17 - TWSC - UNSIGNALIZED INTERSECTIONS WORKSHEET

Analysis Summary

General Information

Analyst	WY	Jurisdiction/Date	1/21/05
Agency or Company	M&E	Major Street	HARDY ST
Analysis Period/Year	2015 PM AMB1	Minor Street	EIWA ST
Comment	2015 AMBIENT PM PK HR FORECAST		

Site Information

Input Data

Lane Configuration	EB			WB			NB			SB		
Lane 1 (curb)		TR			LT			LR				
Lane 2												
Lane 3												
	EB			WB			NB			SB		
Movement	1 (LT)	2 (TH)	3 (RT)	4 (LT)	5 (TH)	6 (RT)	7 (LT)	8 (TH)	9 (RT)	10 (LT)	11 (TH)	12 (RT)
Volume (veh/h)		455	130	150	255		115		245			
PHF		.9	.9	.9	.9		.9		.9			
Proportion of heavy vehicles, HV		3	3	3	3		3		3			
Flow rate		506	144	167	283		128		272			
Flare storage (# of vehs)									0			
Median storage (# of vehs)							0					

Signal upstream of Movement 2 _____ ft Movement 5 _____ ft

Length of study period (h) .25

Output Data

	Lane	Movement	Flow Rate (veh/h)	Capacity (veh/h)	v/c	Queue Length (veh)	Control Delay (s)	LOS	Approach Delay and LOS
NB	1	LR	400	310	1.289	19	186.5	F	186.5
	2								
	3								F
SB	1								
	2								
	3								
		①							
		④	167	931	.179	1	9.7	A	

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CHAPTER 17 - TWSC - UNSIGNALIZED INTERSECTIONS WORKSHEET

Analysis Summary

General Information

Analyst	WY	Jurisdiction/Date	1/21/05
Agency or Company	M&E	Major Street	HARDY ST
Analysis Period/Year	2015 PM AMB2	Minor Street	EIWA ST
Comment	2015 AMB PM FC W/KUHIO-HARDY SIGNAL		

Site Information

Input Data

Lane Configuration	EB			WB			NB			SB		
Lane 1 (curb)		TR			LT			LR				
Lane 2												
Lane 3												
	EB			WB			NB			SB		
Movement	1 (LT)	2 (TH)	3 (RT)	4 (LT)	5 (TH)	6 (RT)	7 (LT)	8 (TH)	9 (RT)	10 (LT)	11 (TH)	12 (RT)
Volume (veh/h)		515	80	95	310		115		245			
PHF		.9	.9	.9	.9		.9		.9			
Proportion of heavy vehicles, HV		3	3	3	3		3		3			
Flow rate		572	89	106	344		128		272			
Flare storage (# of vehs)									0			
Median storage (# of vehs)							0					

Signal upstream of Movement 2 _____ ft Movement 5 _____ ft

Length of study period (h) .25

Output Data

	Lane	Movement	Flow Rate (veh/h)	Capacity (veh/h)	v/c	Queue Length (veh)	Control Delay (s)	LOS	Approach Delay and LOS
NB	1	LR	400	322	1.24	18	165.9	F	165.9
	2								
	3								F
SB	1								
	2								
	3								
		①							
		④	106	923	.114	<1	9.4	A	

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HARDY STREET/UMI STREET

CHAPTER 17 - TWSC - UNSIGNALIZED INTERSECTIONS WORKSHEET

Analysis Summary

General Information

Analyst	ANALYST	Jurisdiction/Date	10/28/03
Agency or Company		Major Street	HARDY ST
Analysis Period/Year	2003 AMEX	Minor Street	UMI ST
Comment	2003 EXISTING AM PEAK HR		

Input Data

Lane Configuration	EB			WB			NB			SB		
Lane 1 (curb)	LTR			LTR			R			LTR		
Lane 2							LT					
Lane 3												
	EB			WB			NB			SB		
Movement	1 (LT)	2 (TH)	3 (RT)	4 (LT)	5 (TH)	6 (RT)	7 (LT)	8 (TH)	9 (RT)	10 (LT)	11 (TH)	12 (RT)
Volume (veh/h)	55	255	185	45	160	40	70	55	65	15	85	125
PHF	.9	.9	.9	.9	.9	.9	.9	.9	.9	.9	.9	.9
Proportion of heavy vehicles, HV	3	3	3	3	3	3	3	3	3	3	3	3
Flow rate	61	283	206	50	178	44	78	61	72	17	94	139
Flare storage (# of vehs)									0			0
Median storage (# of vehs)							0			0		

Signal upstream of Movement 2 _____ ft Movement 5 _____ ft

Length of study period (h) .25

Output Data

	Lane	Movement	Flow Rate (veh/h)	Capacity (veh/h)	v/c	Queue Length (veh)	Control Delay (s)	LOS	Approach Delay and LOS
NB	1	R	72	660	.109	<1	11.1	B	54.7
	2	LT	133	168	.79	5	78.2	F	
	3								F
SB	1	LTR	239	414	.578	4	25	C	25
	2								
	3								C
		①	61	1341	.046	<1	7.8	A	
		④	50	1069	.047	<1	8.5	A	

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CHAPTER 17 - TWSC - UNSIGNALIZED INTERSECTIONS WORKSHEET

Analysis Summary

General Information

Analyst	WY	Jurisdiction/Date	1/21/05
Agency or Company	M&E	Major Street	HARDY ST
Analysis Period/Year	2015 AM AMB1	Minor Street	UMI ST
Comment	2015 AMBIENT AM PK HR FORECAST		

Input Data

Lane Configuration	EB			WB			NB			SB		
Lane 1 (curb)	LTR			LTR			R			LTR		
Lane 2							LT					
Lane 3												
	EB			WB			NB			SB		
Movement	1 (LT)	2 (TH)	3 (RT)	4 (LT)	5 (TH)	6 (RT)	7 (LT)	8 (TH)	9 (RT)	10 (LT)	11 (TH)	12 (RT)
Volume (veh/h)	65	315	220	50	205	50	85	65	80	20	100	135
PHF	.9	.9	.9	.9	.9	.9	.9	.9	.9	.9	.9	.9
Proportion of heavy vehicles, HV	3	3	3	3	3	3	3	3	3	3	3	3
Flow rate	72	350	244	56	228	56	94	72	89	22	111	150
Flare storage (# of vehs)									0			0
Median storage (# of vehs)							0			0		

Signal upstream of Movement 2 _____ ft Movement 5 _____ ft

Length of study period (h) .25

Output Data

	Lane	Movement	Flow Rate (veh/h)	Capacity (veh/h)	v/c	Queue Length (veh)	Control Delay (s)	LOS	Approach Delay and LOS
NB	1	R	89	590	.151	1	12.2	B	294.1
	2	LT	166	96	1.733	13	445.2	F	
	3								F
SB	1	LTR	283	280	1.01	10	96.6	F	96.6
	2								
	3								F
		①	72	1273	.057	<1	8	A	
		④	56	977	.057	<1	8.9	A	

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CHAPTER 17 - TWSC - UNSIGNALIZED INTERSECTIONS WORKSHEET

Analysis Summary

General Information

Analyst	WY	Jurisdiction/Date	1/21/05
Agency or Company	M&E	Major Street	HARDY ST
Analysis Period/Year	2015 AM AMB2	Minor Street	UMI ST
Comment	2015 AMB AM FC W/KUHIO-HARDY SIGNAL		

Input Data

Lane Configuration	EB			WB			NB			SB		
Lane 1 (curb)	LTR			LTR			R			LTR		
Lane 2							LT					
Lane 3												
	EB			WB			NB			SB		
Movement	1 (LT)	2 (TH)	3 (RT)	4 (LT)	5 (TH)	6 (RT)	7 (LT)	8 (TH)	9 (RT)	10 (LT)	11 (TH)	12 (RT)
Volume (veh/h)	65	345	250	50	205	50	85	65	80	20	100	135
PHF	.9	.9	.9	.9	.9	.9	.9	.9	.9	.9	.9	.9
Proportion of heavy vehicles, HV	3	3	3	3	3	3	3	3	3	3	3	3
Flow rate	72	383	278	56	228	56	94	72	89	22	111	150
Flare storage (# of vehs)									0			0
Median storage (# of vehs)							0			0		

Signal upstream of Movement 2 _____ ft Movement 5 _____ ft

Length of study period (h) .25

Output Data

	Lane	Movement	Flow Rate (veh/h)	Capacity (veh/h)	v/c	Queue Length (veh)	Control Delay (s)	LOS	Approach Delay and LOS
NB	1	R	89	553	.161	1	12.8	B	401
	2	LT	166	80	2.075	15	609.2	F	
	3								F
SB	1	LTR	283	257	1.103	12	128.7	F	128.7
	2								
	3								F
		①	72	1273	.057	<1	8	A	
		④	56	923	.06	<1	9.2	A	

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CHAPTER 17 - TWSC - UNSIGNALIZED INTERSECTIONS WORKSHEET

Analysis Summary

General Information

Analyst	WY	Jurisdiction/Date	1/16/05
Agency or Company		Major Street	HARDY ST
Analysis Period/Year	2015 20AMRE	Minor Street	UMI ST
Comment	2015 RCMND 20% AM PEAK HR		

Input Data

Lane Configuration	EB			WB			NB			SB		
Lane 1 (curb)	LTR			LTR			R			LTR		
Lane 2							LT					
Lane 3												
	EB			WB			NB			SB		
Movement	1 (LT)	2 (TH)	3 (RT)	4 (LT)	5 (TH)	6 (RT)	7 (LT)	8 (TH)	9 (RT)	10 (LT)	11 (TH)	12 (RT)
Volume (veh/h)	65	200	245	85	140	50	120	95	130	15	130	170
PHF	.9	.9	.9	.9	.9	.9	.9	.9	.9	.9	.9	.9
Proportion of heavy vehicles, HV	3	3	3	3	3	3	3	3	3	3	3	3
Flow rate	72	222	272	94	156	56	133	106	144	17	144	189
Flare storage (# of vehs)									0			0
Median storage (# of vehs)							0			0		

Signal upstream of Movement 2 _____ ft Movement 5 _____ ft

Length of study period (h) .25

Output Data

	Lane	Movement	Flow Rate (veh/h)	Capacity (veh/h)	v/c	Queue Length (veh)	Control Delay (s)	LOS	Approach Delay and LOS
NB	1	R	72	684	.105	<1	10.9	B	255.2
	2	LT	133	85	1.562	11	387.4	F	
	3								F
SB	1	LTR	289	400	.723	6	34.2	D	34.2
	2								
	3								D
		①	72	1353	.053	<1	7.8	A	
		④	94	1064	.089	<1	8.7	A	

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CHAPTER 17 - ROUNDABOUTS WORKSHEET

General Information

Analyst	wy	Jurisdiction/Date	Jurisdiction 1/15/05
Agency or Company	me	EB-WB Street	hardy st
Analysis Period/Year	am20%re 2015	NB-SB Street	umi st
Comment	2015 20% am peak hr forecastII		

Volume Adjustments

		EB	WB	NB	SB
LT Traffic	Volume, veh/h	65	85	120	20
	PHF	0.90	0.90	0.90	0.90
	Flow rate, veh/h	72	94	133	22
TH Traffic	Volume, veh/h	200	140	95	130
	PHF	0.90	0.90	0.90	0.90
	Flow rate, veh/h	222	156	106	144
RT Traffic	Volume, veh/h	245	50	130	170
	PHF	0.90	0.90	0.90	0.90
	Flow rate, veh/h	272	56	144	189

Approach Flow Computation / **Circulating Flow Computation**

Approach Flow (veh/h)	v_a (veh/h)	Approach Flow (veh/h)	v_c (veh/h)
$v_{a,E} = v_1 + v_2 + v_3$	567	$v_{c,E} = v_4 + v_{10} + v_{11}$	261
$v_{a,W} = v_4 + v_5 + v_6$	306	$v_{c,W} = v_1 + v_7 + v_8$	311
$v_{a,N} = v_7 + v_8 + v_9$	383	$v_{c,N} = v_1 + v_2 + v_{10}$	317
$v_{a,S} = v_{10} + v_{11} + v_{12}$	356	$v_{c,S} = v_4 + v_5 + v_7$	383

Gap Acceptance Parameters

☐ Field data?

	Critical Gap (s)	Follow-up Time (s)
Upperbound value	4.1	2.6
Lowerbound value	4.6	3.1

Capacity Computation

		EB	WB	NB	SB
Capacity (Equation 17-70) (veh/h)	Upperbound	1128	1085	1080	1024
	Lowerbound	929	890	885	835
v/c Ratio	Upperbound	0.502	0.282	0.355	0.347
	Lowerbound	0.610	0.343	0.433	0.426

CHAPTER 17 - TWSC - UNSIGNALIZED INTERSECTIONS WORKSHEET

Analysis Summary

General Information

Analyst	ANALYST	Jurisdiction/Date	10/28/03
Agency or Company		Major Street	HARDY ST
Analysis Period/Year	2003 PMEX	Minor Street	UMI ST
Comment	2003 EXISTING PM PEAK HR		

Input Data

Lane Configuration	EB			WB			NB			SB		
Lane 1 (curb)	LTR			LTR			R			LTR		
Lane 2							LT					
Lane 3												
	EB			WB			NB			SB		
Movement	1 (LT)	2 (TH)	3 (RT)	4 (LT)	5 (TH)	6 (RT)	7 (LT)	8 (TH)	9 (RT)	10 (LT)	11 (TH)	12 (RT)
Volume (veh/h)	105	235	105	30	170	40	65	95	35	8	40	60
PHF	.9	.9	.9	.9	.9	.9	.9	.9	.9	.9	.9	.9
Proportion of heavy vehicles, HV	3	3	3	3	3	3	3	3	3	3	3	3
Flow rate	117	261	117	33	189	44	72	106	39	9	44	67
Flare storage (# of vehs)									0			0
Median storage (# of vehs)							0			0		

Signal upstream of Movement 2 _____ ft Movement 5 _____ ft

Length of study period (h) .25

Output Data

	Lane	Movement	Flow Rate (veh/h)	Capacity (veh/h)	v/c	Queue Length (veh)	Control Delay (s)	LOS	Approach Delay and LOS
NB	1	R	41	719	.057	<1	10.3	B	45.4
	2	LT	160	222	.721	5	54.4	F	
	3								E
SB	1	LTR	167	338	.494	3	25.6	D	25.6
	2								
	3								D
		①	117	1328	.088	<1	8	A	
		④	33	1175	.028	<1	8.2	A	

CHAPTER 17 - TWSC - UNSIGNALIZED INTERSECTIONS WORKSHEET

Analysis Summary

General Information

Analyst	WY	Jurisdiction/Date	1/21/05
Agency or Company	M&E	Major Street	HARDY ST
Analysis Period/Year	2015 PM AMB1	Minor Street	UMI ST
Comment	2015 AMBIENT PM PK HR FORECAST		

Input Data

Lane Configuration	EB			WB			NB			SB		
Lane 1 (curb)	LTR			LTR			R			LTR		
Lane 2							LT					
Lane 3												
	EB			WB			NB			SB		
Movement	1 (LT)	2 (TH)	3 (RT)	4 (LT)	5 (TH)	6 (RT)	7 (LT)	8 (TH)	9 (RT)	10 (LT)	11 (TH)	12 (RT)
Volume (veh/h)	120	325	125	35	220	50	75	115	45	10	45	65
PHF	.9	.9	.9	.9	.9	.9	.9	.9	.9	.9	.9	.9
Proportion of heavy vehicles, HV	3	3	3	3	3	3	3	3	3	3	3	3
Flow rate	133	361	139	39	244	56	83	128	50	11	50	72
Flare storage (# of vehs)									0			0
Median storage (# of vehs)							0			0		

Signal upstream of Movement 2 _____ ft Movement 5 _____ ft

Length of study period (h) .25

Output Data

	Lane	Movement	Flow Rate (veh/h)	Capacity (veh/h)	v/c	Queue Length (veh)	Control Delay (s)	LOS	Approach Delay and LOS
NB	1	R	50	623	.08	<1	11.3	B	239.8
	2	LT	211	145	1.451	14	294	F	
	3								F
SB	1	LTR	133	233	.571	3	39.3	E	39.3
	2								
	3								E
		①	133	1255	.106	<1	8.2	A	
		④	39	1059	.037	<1	8.5	A	

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CHAPTER 17 - TWSC - UNSIGNALIZED INTERSECTIONS WORKSHEET

Analysis Summary

General Information

Analyst	WY	Jurisdiction/Date	1/21/05
Agency or Company	M&E	Major Street	HARDY ST
Analysis Period/Year	2015 PM AMB2	Minor Street	UMI ST
Comment	2015 AMB PM FC W/KUHIO-HARDY SIGNAL		

Input Data

Lane Configuration	EB			WB			NB			SB		
Lane 1 (curb)	LTR			LTR			R			LTR		
Lane 2							LT					
Lane 3												
	EB			WB			NB			SB		
Movement	1 (LT)	2 (TH)	3 (RT)	4 (LT)	5 (TH)	6 (RT)	7 (LT)	8 (TH)	9 (RT)	10 (LT)	11 (TH)	12 (RT)
Volume (veh/h)	120	355	125	35	220	50	75	115	45	10	45	65
PHF	.9	.9	.9	.9	.9	.9	.9	.9	.9	.9	.9	.9
Proportion of heavy vehicles, HV	3	3	3	3	3	3	3	3	3	3	3	3
Flow rate	133	394	139	39	244	56	83	128	50	11	50	72
Flare storage (# of vehs)									0			0
Median storage (# of vehs)							0			0		

Signal upstream of Movement 2 _____ ft Movement 5 _____ ft

Length of study period (h) .25

Output Data

	Lane	Movement	Flow Rate (veh/h)	Capacity (veh/h)	v/c	Queue Length (veh)	Control Delay (s)	LOS	Approach Delay and LOS
NB	1	R	50	596	.084	<1	11.6	B	273.8
	2	LT	211	137	1.543	15	336	F	
	3								F
SB	1	LTR	133	216	.616	4	45.2	E	45.2
	2								
	3								E
		①	133	1255	.106	<1	8.2	A	
		④	39	1029	.038	<1	8.6	A	

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CHAPTER 17 - ROUNDABOUTS WORKSHEET

General Information | **Site Information**

Analyst	wy	Jurisdiction/Date	Jurisdiction 1/15/05
Agency or Company	me	EB-WB Street	hardy st
Analysis Period/Year	am 2015	NB-SB Street	umi st
Comment	2015 forecast pm peak hrll		

Volume Adjustments

		EB	WB	NB	SB
LT Traffic	Volume, veh/h	160	70	160	10
	PHF	0.90	0.90	0.90	0.90
	Flow rate, veh/h	178	78	178	11
TH Traffic	Volume, veh/h	320	170	175	75
	PHF	0.90	0.90	0.90	0.90
	Flow rate, veh/h	356	189	194	83
RT Traffic	Volume, veh/h	155	50	100	45
	PHF	0.90	0.90	0.90	0.90
	Flow rate, veh/h	172	56	111	50

Approach Flow Computation | **Circulating Flow Computation**

Approach Flow (veh/h)	v_a (veh/h)	Approach Flow (veh/h)	v_c (veh/h)
$v_{a,E} = v_1 + v_2 + v_3$	706	$v_{c,E} = v_4 + v_{10} + v_{11}$	172
$v_{a,W} = v_4 + v_5 + v_6$	322	$v_{c,W} = v_1 + v_7 + v_8$	550
$v_{a,N} = v_7 + v_8 + v_9$	483	$v_{c,N} = v_1 + v_2 + v_{10}$	544
$v_{a,S} = v_{10} + v_{11} + v_{12}$	144	$v_{c,S} = v_4 + v_5 + v_7$	444

Gap Acceptance Parameters

☐ Field data?

	Critical Gap (s)	Follow-up Time (s)
Upperbound value	4.1	2.6
Lowerbound value	4.6	3.1

Capacity Computation

		EB	WB	NB	SB
Capacity (Equation 17-70) (veh/h)	Upperbound	1210	897	901	976
	Lowerbound	1003	722	726	792
v/c Ratio	Upperbound	0.583	0.359	0.537	0.148
	Lowerbound	0.704	0.446	0.686	0.182

CHAPTER 17 - TWSC - UNSIGNALIZED INTERSECTIONS WORKSHEET

Analysis Summary

General Information | **Site Information**

Analyst	WY	Jurisdiction/Date	1/16/05
Agency or Company		Major Street	HARDY ST
Analysis Period/Year	2015 PMRE	Minor Street	UMI ST
Comment	2015 REC 20% PM PEAK HR		

Input Data

Lane Configuration	EB			WB			NB			SB		
Lane 1 (curb)	LTR			LTR			R			LTR		
Lane 2							LT					
Lane 3												
	EB			WB			NB			SB		
Movement	1 (LT)	2 (TH)	3 (RT)	4 (LT)	5 (TH)	6 (RT)	7 (LT)	8 (TH)	9 (RT)	10 (LT)	11 (TH)	12 (RT)
Volume (veh/h)	160	320	155	70	170	50	160	175	100	10	75	45
PHF	.9	.9	.9	.9	.9	.9	.9	.9	.9	.9	.9	.9
Proportion of heavy vehicles, HV	3	3	3	3	3	3	3	3	3	3	3	3
Flow rate	178	356	172	78	189	56	178	194	111	11	83	50
Flare storage (# of vehs)									0			0
Median storage (# of vehs)							0			0		

Signal upstream of Movement 2 _____ ft Movement 5 _____ ft

Length of study period (h) .25

Output Data

	Lane	Movement	Flow Rate (veh/h)	Capacity (veh/h)	v/c	Queue Length (veh)	Control Delay (s)	LOS	Approach Delay and LOS
NB	1	R	41	614	.067	<1	11.3	B	407.9
	2	LT	160	86	1.86	14	509.5	F	
	3								F
SB	1	LTR	150	176	.85	6	86.3	F	86.3
	2								
	3								F
		①	178	1316	.135	<1	8.2	A	
		④	78	1034	.075	<1	8.8	A	

UMI STREET/COUNTY-STATE DRIVEWAY

CHAPTER 17 - TWSC - UNSIGNALIZED INTERSECTIONS WORKSHEET

Analysis Summary

General Information

Analyst	WY	Jurisdiction/Date	1/21/05
Agency or Company	M&E	Major Street	UMI STREET
Analysis Period/Year	2003 AMEX	Minor Street	COUNTY/STATE DRIVEWAY
Comment	2003 EXISTING AM PK HR		

Input Data

Lane Configuration	SB			NB			EB			WB		
Lane 1 (curb)	TR			LT			LR					
Lane 2												
Lane 3												
	SB			NB			EB			WB		
Movement	1 (LT)	2 (TH)	3 (RT)	4 (LT)	5 (TH)	6 (RT)	7 (LT)	8 (TH)	9 (RT)	10 (LT)	11 (TH)	12 (RT)
Volume (veh/h)	0	230	25	0	170		7		15			
PHF		.9	.9	.9	.9		.9		.9			
Proportion of heavy vehicles, HV		3	3	3	3		3		3			
Flow rate		256	28	0	189		8		17			
Flare storage (# of vehs)									0			
Median storage (# of vehs)							0					

Signal upstream of Movement 2 _____ ft Movement 5 _____ ft

Length of study period (h) .25

Output Data

	Lane	Movement	Flow Rate (veh/h)	Capacity (veh/h)	v/c	Queue Length (veh)	Control Delay (s)	LOS	Approach Delay and LOS
EB	1	LR	25	685	.036	<1	10.5	B	10.5
	2								B
	3								
WB	1								
	2								
	3								
		①							
		④	0	1273	0	<1	7.8	A	

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CHAPTER 17 - TWSC - UNSIGNALIZED INTERSECTIONS WORKSHEET

Analysis Summary

General Information

Analyst	WY	Jurisdiction/Date	1/21/05
Agency or Company	M&E	Major Street	UMI STREET
Analysis Period/Year	2003 AMEX	Minor Street	COUNTY/STATE DRIVEWAY
Comment	2003 EXISTING AM PK HR		

Input Data

Lane Configuration	SB			NB			EB			WB		
Lane 1 (curb)	TR			LT			LR					
Lane 2												
Lane 3												
	SB			NB			EB			WB		
Movement	1 (LT)	2 (TH)	3 (RT)	4 (LT)	5 (TH)	6 (RT)	7 (LT)	8 (TH)	9 (RT)	10 (LT)	11 (TH)	12 (RT)
Volume (veh/h)	0	300	0	0	170		7		15			
PHF		.9	.9	.9	.9		.9		.9			
Proportion of heavy vehicles, HV		3	3	3	3		3		3			
Flow rate		333	0	0	189		8		17			
Flare storage (# of vehs)									0			
Median storage (# of vehs)							0					

Signal upstream of Movement 2 _____ ft Movement 5 _____ ft

Length of study period (h) .25

Output Data

	Lane	Movement	Flow Rate (veh/h)	Capacity (veh/h)	v/c	Queue Length (veh)	Control Delay (s)	LOS	Approach Delay and LOS
EB	1	LR	25	630	.04	<1	10.9	B	10.9
	2								B
	3								
WB	1								
	2								
	3								
		①							
		④	0	1220	0	<1	7.9	A	

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CHAPTER 17 - TWSC - UNSIGNALIZED INTERSECTIONS WORKSHEET

Analysis Summary

General Information

Analyst	WY	Jurisdiction/Date	1/21/05
Agency or Company	M&E	Major Street	UMI STREET
Analysis Period/Year	2015 AM AMB2	Minor Street	COUNTY/STATE DRIVEWAY
Comment	2015 AMB AM FC W/KUHIO-HARDY SIGNAL		

Input Data

Lane Configuration	SB	NB	EB	WB
Lane 1 (curb)	TR	LT	LR	
Lane 2				
Lane 3				

	SB			NB			EB			WB		
Movement	1 (LT)	2 (TH)	3 (RT)	4 (LT)	5 (TH)	6 (RT)	7 (LT)	8 (TH)	9 (RT)	10 (LT)	11 (TH)	12 (RT)
Volume (veh/h)		330	0	0	205		7		15			
PHF		.9	.9	.9	.9		.9		.9			
Proportion of heavy vehicles, HV		3	3	3	3		3		3			
Flow rate		367	0	0	228		8		17			
Flare storage (# of vehs)									0			
Median storage (# of vehs)							0					

Signal upstream of Movement 2 _____ ft Movement 5 _____ ft

Length of study period (h) .25

Output Data

	Lane	Movement	Flow Rate (veh/h)	Capacity (veh/h)	v/c	Queue Length (veh)	Control Delay (s)	LOS	Approach Delay and LOS
EB	1	LR	25	591	.042	<1	11.4	B	11.4
	2								
	3								B
WB	1								
	2								
	3								
		①							
		④	0	1186	0	<1	8	A	

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CHAPTER 17 - TWSC - UNSIGNALIZED INTERSECTIONS WORKSHEET

Analysis Summary

General Information

Analyst	WY	Jurisdiction/Date	1/15/05
Agency or Company	M&E	Major Street	UMI STREET
Analysis Period/Year	2015 AM20RE	Minor Street	COUNTY/STATE DRIVEWAY
Comment	2015 RECMNDED 20% AM PK HR		

Input Data

Lane Configuration	SB	NB	EB	WB
Lane 1 (curb)	TR	LT	R	
Lane 2			L	
Lane 3				

	SB			NB			EB			WB		
Movement	1 (LT)	2 (TH)	3 (RT)	4 (LT)	5 (TH)	6 (RT)	7 (LT)	8 (TH)	9 (RT)	10 (LT)	11 (TH)	12 (RT)
Volume (veh/h)		365	60	165	305		10		25			
PHF		.9	.9	.9	.9		.9		.9			
Proportion of heavy vehicles, HV		3	3	3	3		3		3			
Flow rate		406	67	183	339		11		28			
Flare storage (# of vehs)									0			
Median storage (# of vehs)							0					

Signal upstream of Movement 2 _____ ft Movement 5 _____ ft

Length of study period (h) .25

Output Data

	Lane	Movement	Flow Rate (veh/h)	Capacity (veh/h)	v/c	Queue Length (veh)	Control Delay (s)	LOS	Approach Delay and LOS
EB	1	R	28	616	.045	<1	11.1	B	15.3
	2	L	11	183	.06	<1	26	D	
	3								C
WB	1								
	2								
	3								
		①							
		④	183	1084	.169	1	9	A	

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CHAPTER 17 - TWSC - UNSIGNALIZED INTERSECTIONS WORKSHEET

Analysis Summary

General Information

Analyst	WY	Jurisdiction/Date	1/21/05
Agency or Company	M&E	Major Street	UMI STREET
Analysis Period/Year	2003 PMEX	Minor Street	COUNTY/STATE DRIVEWAY
Comment	2003 EXISTING PM PK HR		

Input Data

Lane Configuration	SB			NB			EB			WB		
Lane 1 (curb)	TR			LT			LR					
Lane 2												
Lane 3												
	SB			NB			EB			WB		
Movement	1 (LT)	2 (TH)	3 (RT)	4 (LT)	5 (TH)	6 (RT)	7 (LT)	8 (TH)	9 (RT)	10 (LT)	11 (TH)	12 (RT)
Volume (veh/h)	0	205	0	0	130		11		20			
PHF		.9	.9	.9	.9		.9		.9			
Proportion of heavy vehicles, HV		3	3	3	3		3		3			
Flow rate		228	0	0	144		12		22			
Flare storage (# of vehs)									0			
Median storage (# of vehs)							0					

Signal upstream of Movement 2 _____ ft Movement 5 _____ ft

Length of study period (h) .25

Output Data

	Lane	Movement	Flow Rate (veh/h)	Capacity (veh/h)	v/c	Queue Length (veh)	Control Delay (s)	LOS	Approach Delay and LOS
EB	1	LR	31	733	.042	<1	10.1	B	10.1
	2								
	3								B
WB	1								
	2								
	3								
		①							
		④	0	1335	0	<1	7.7	A	

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CHAPTER 17 - TWSC - UNSIGNALIZED INTERSECTIONS WORKSHEET

Analysis Summary

General Information

Analyst	WY	Jurisdiction/Date	1/21/05
Agency or Company	M&E	Major Street	UMI STREET
Analysis Period/Year	2015 PM AMB1	Minor Street	COUNTY/STATE DRIVEWAY
Comment	2015 AMBIENT PM PK HR		

Input Data

Lane Configuration	SB			NB			EB			WB		
Lane 1 (curb)	TR			LT			LR					
Lane 2												
Lane 3												
	SB			NB			EB			WB		
Movement	1 (LT)	2 (TH)	3 (RT)	4 (LT)	5 (TH)	6 (RT)	7 (LT)	8 (TH)	9 (RT)	10 (LT)	11 (TH)	12 (RT)
Volume (veh/h)	0	245	0	0	155		15		15			
PHF		.9	.9	.9	.9		.9		.9			
Proportion of heavy vehicles, HV		3	3	3	3		3		3			
Flow rate		272	0	0	172		17		17			
Flare storage (# of vehs)									0			
Median storage (# of vehs)							0					

Signal upstream of Movement 2 _____ ft Movement 5 _____ ft

Length of study period (h) .25

Output Data

	Lane	Movement	Flow Rate (veh/h)	Capacity (veh/h)	v/c	Queue Length (veh)	Control Delay (s)	LOS	Approach Delay and LOS
EB	1	LR	34	652	.052	<1	10.8	B	10.8
	2								
	3								B
WB	1								
	2								
	3								
		①							
		④	0	1285	0	<1	7.8	A	

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CHAPTER 17 - TWSC - UNSIGNALIZED INTERSECTIONS WORKSHEET

Analysis Summary

General Information

Analyst	WY	Jurisdiction/Date	1/21/05
Agency or Company	M&E	Major Street	UMI STREET
Analysis Period/Year	2015 PM AMB2	Minor Street	COUNTY/STATE DRIVEWAY
Comment	2015 AMB PM FC W/KUHIO-HARDY SIGNAL		

Input Data

Lane Configuration	SB			NB			EB			WB		
Lane 1 (curb)	TR			LT			LR					
Lane 2												
Lane 3												
	SB			NB			EB			WB		
Movement	1 (LT)	2 (TH)	3 (RT)	4 (LT)	5 (TH)	6 (RT)	7 (LT)	8 (TH)	9 (RT)	10 (LT)	11 (TH)	12 (RT)
Volume (veh/h)	0	275	0	0	155		15		15			
PHF		.9	.9	.9	.9		.9		.9			
Proportion of heavy vehicles, HV		3	3	3	3		3		3			
Flow rate		306	0	0	172		17		17			
Flare storage (# of vehs)									0			
Median storage (# of vehs)							0					

Signal upstream of Movement 2 _____ ft Movement 5 _____ ft

Length of study period (h) .25

Output Data

	Lane	Movement	Flow Rate (veh/h)	Capacity (veh/h)	v/c	Queue Length (veh)	Control Delay (s)	LOS	Approach Delay and LOS
EB	1	LR	34	624	.054	<1	11.1	B	11.1
	2								
	3								B
WB	1								
	2								
	3								
		①							
		④	0	1250	0	<1	7.9	A	

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CHAPTER 17 - TWSC - UNSIGNALIZED INTERSECTIONS WORKSHEET

Analysis Summary

General Information

Analyst	WY	Jurisdiction/Date	1/11/05
Agency or Company	M&E	Major Street	UMI STREET
Analysis Period/Year	2015 PMRE	Minor Street	COUNTY/STATE DRIVEWAY
Comment	2015 RECMNDED PM PK HR		

Input Data

Lane Configuration	SB			NB			EB			WB		
Lane 1 (curb)	TR			LT			R					
Lane 2							L					
Lane 3												
	SB			NB			EB			WB		
Movement	1 (LT)	2 (TH)	3 (RT)	4 (LT)	5 (TH)	6 (RT)	7 (LT)	8 (TH)	9 (RT)	10 (LT)	11 (TH)	12 (RT)
Volume (veh/h)		330	10	95	355		10		95			
PHF		.9	.9	.9	.9		.9		.9			
Proportion of heavy vehicles, HV		3	3	3	3		3		3			
Flow rate		367	11	106	394		11		106			
Flare storage (# of vehs)									0			
Median storage (# of vehs)							0					

Signal upstream of Movement 2 _____ ft Movement 5 _____ ft

Length of study period (h) .25

Output Data

	Lane	Movement	Flow Rate (veh/h)	Capacity (veh/h)	v/c	Queue Length (veh)	Control Delay (s)	LOS	Approach Delay and LOS
EB	1	R	106	672	.158	1	11.4	B	12.2
	2	L	11	252	.044	<1	19.9	C	
	3								B
WB	1								
	2								
	3								
		①							
		④	106	1175	.09	<1	8.4	A	

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Appendix B

ESTIMATE OF PROBABLE COST

FOR

LIHUE CIVIC CENTER MASTER PLAN

PREPARED FOR

PBR HAWAII

4 MAY 2005

PROJECT SUMMARY

PROJECT SUMMARY

BASIS OF ESTIMATE

The project comprises the construction of the proposed master plan renovations and additions to the existing Lihu'e Civic Center, County of Kaua'i, Hawaii in eight phases.

The estimate is based on the draft master plan drawings prepared by PBR Hawaii received on 3/23/05. However, Phase 1 incorporates the escalated DPW estimate dated 3/22/05 for a previously proposed reconfiguration of "Hardy Street" as per DPW drawings dated 12/11/1999 with additional work as per the above-mentioned draft master plan drawings, which includes additional traffic signals at the "Kuhio Highway" intersection, a roundabout at the "'Umi Street" intersection, and new center medians/turn lanes, bike lanes and landscaping between "Kuhio Highway" and "'Umi Street".

Where information was insufficient, assumptions and allowances were made, based wherever possible on discussions with the Land Planners.

Pricing is based on May 2005 costs. A design and pricing contingency of 10% has been allowed for in the estimate under the "margins and adjustments" line items within each Phase.

It is assumed that the project will be competitively bid and that the contractor will be required to pay prevailing wage rates.

No escalation allowance has been included in this estimate.

ITEMS SPECIFICALLY EXCLUDED

The following items have been excluded from the estimate:

- Additional parking structure above grade at War Memorial @ $35,000 per stall
- Additional parking structure above grade at Post Office @ $40,000 per stall
- New traffic signals at Akahi & Hardy Street intersection @ $250,000
- New traffic signals at Kele & Rice Street intersection @ $250,000
- Parking control device per single entrance/exit to parking structure/lot including ticket spitter & cashier booth @ $30,000
- Relocation of overhead utility lines underground @ $350 per lf

TOTAL COST SUMMARY

PARKING STRUCTURE PHASE 6 BELOW GRADE

LIHUE CIVIC CENTER MASTTER PLAN PROBABLE COST ESTIMATE

TOTAL COST SUMMARY

GFA: Gross floor area
Rates current at March 2005

Level Zone	GFA SF	Cost /SF	Total Cost
A Phase 1			5,852,000
B Phase 2			832,000
C Phase 3			1,388,000
D Phase 4 (1 level below grade)			5,280,000
E Phase 5			698,000
F Phase 6 (2 levels below grade)			7,902,000
G Phase 7			980,000
H Phase 8			220,000
Totals			$23,152,000

ITEM DETAILS

PARKING STRUCTURE PHASE 6 BELOW GRADE

ITEM DETAILS

A Phase 1

Rates current at March 2005

Item	Description	Unit	Qty	Rate	$
RO	ROADWAYS				
1	Work to existing Hardy Street as per escalated DPW estimate dated 3/22/05	Item			3,300,000
2	Additional center median/turn lanes & landscaping between Kuhio & 'Umi Sts	Item			200,000
3	Additional roundabout at Hardy & Umi Street intersection	Item			150,000
4	Additional bike lanes and sidewalk landscaping between Kuhio & 'Umi Sts	Item			300,000
5	Additional traffic signals at Hardy Street & Kuhio Highway intersection	Item			250,000
	Element RO total				4,200,000
XK	SITE PLUMBING UTILITIES				
1	Additional domestic water	Item			10,000
2	Additional fire protection	Item			15,000
3	Additional sanitary sewer	Item			10,000
4	Additional storm sewer	Item			50,000
	Element XK total				85,000
XE	SITE ELECTRICAL UTILITIES				
1	Additional electrical & communication	Item			25,000
	Element XE total				25,000
PR	GENERAL REQUIREMENTS				
1	Additional temporary work	Item			25,000
2	Margins & adjustments	Item			1,517,000
	Element PR total				1,542,000
	Total				5,852,000

ITEM DETAILS

B Phase 2

Rates current at March 2005

Item	Description	Unit	Qty	Rate	$
XP	SITE PREPARATION				
1	Remove existing curbing	LF	1,893		Incl.
2	Remove existing parking surfaces incl curbs & gutters	SF	4,420	1.00	4,420
3	Demolish existing curb islands	SF	6,504	5.00	32,520
	Element XP total				36,940
XR	SITE IMPROVEMENTS				
1	New Curbing	LF	2,425	30.00	72,750
2	New road surfaces incl fill	SF	6,504	4.00	26,016
3	New coating surface to existing parking areas	SF	47,496	1.00	47,496
4	ADA ramp	EA	4	3000.00	12,000
5	Striping to parking areas	SF	54,000	0.75	40,500
6	Concrete paving	SF	1,818	8.00	14,544
7	Special paving	SF	373	15.00	5,595
8	Relocate parking meters	EA	64	500.00	32,000
9	Landscaping	SF	12,659	5.00	63,295
	Element XR total				314,196
XK	SITE PLUMBING UTILITIES				
1	Reconfigure sanitary sewer	Item			120,000
2	Reconfigure storm sewer	Item			120,000
	Element XK total				240,000
XE	SITE ELECTRICAL UTILITIES				
1	Reconfigure electrical distribution & lighting	Item			25,000
	Element XE total				25,000
PR	GENERAL REQUIREMENTS				
1	Margins & adjustments	Item			215,864
	Element PR total				215,864
	Total				832,000

ITEM DETAILS

C Phase 3

Rates current at March 2005

Item	Description	Unit	Qty	Rate	$
XP	SITE PREPARATION				
1	Demolish screen walls	LF	25	30.00	750
2	Demolish curbs & gutters to roadways	LF	647		Incl.
3	Demolish curbs to parking lots	LF	1,246		Incl.
4	Demolish roadway surfaces incl curbs & gutters	SY	16,985	1.00	16,985
5	Demolish parking lot surfaces incl curbs & flatwork	SY	4,249	1.50	6,374
6	Demolish plant material	SF	2,420	1.00	2,420
7	Disposal of demolished materials	CY	841	20.00	16,820
	Element XP total				43,349
XR	SITE IMPROVEMENTS				
1	Making good public roads at junction between new & existing work	LF	475	10.00	4,750
2	Curbs to parking lots and roadways	LF	1,421	30.00	42,630
3	Pavement to parking lots incl grading & base	SF	19,511	4.00	78,044
4	New coating surface to existing parking lots	SF	11,964	2.00	23,928
5	Road markings to parking lots	SF	31,475	0.20	6,295
6	Pavement to walkways incl grading & base	SF	4,364	10.00	43,640
7	Special paving	SF	3,785	15.00	56,775
8	Premium on walkways for steps and ADA ramps	SF	338	10.00	3,380
9	Signage to parking lots and walkways	Item			15,000
10	Landscaping	SF	46,756	5.00	233,780
	Element XR total				508,222
XK	SITE PLUMBING UTILITIES				
1	Reconfigure sanitary sewer	Item			210,000
2	Reconfigure storm sewer	Item			210,000
	Element XK total				420,000
XE	SITE ELECTRICAL UTILITIES				
1	Reconfigure electrical distribution & lighting	Item			50,000
	Element XE total				50,000
			Page Total		1,021,571

ITEM DETAILS

C Phase 3

Rates current at March 2005

Item	Description	Unit	Qty	Rate	$
PR	GENERAL REQUIREMENTS				
1	Margins & Adjustments	Item			366,429
	Element PR total				366,429
			Total		1,388,000

ITEM DETAILS

D Phase 4 (1 level below grade)

Rates current at March 2005

Item	Description	Unit	Qty	Rate	$
XP	SITE PREPARATION				
1	Remove existing curbing	LF	835		Incl.
2	Remove existing parking surface incl curbs & gutters	SF	50,000	1.00	50,000
	Element XP total				50,000
SB	SUBSTRUCTURE				
1	Standard foundations to parking structure	SF	24,500	6.00	147,000
2	Pile foundation system	SF	24,500		Excl.
3	Concrete slab on grade incl base	SF	24,500	6.00	147,000
4	Premium for elevator pit	EA	1	12000.00	12,000
5	Excavation for basement parking	CY	9,075	37.00	335,775
6	Disposal of excavated materail	CY	9,075	10.00	90,750
7	Lateral support to excavations for basement parking	SF	7,800	25.00	195,000
8	Concrete retaining wall to ramps	SF	1,350	25.00	33,750
9	Concete ramp	SF	2,980	15.00	44,700
10	Concrete retaining walls to parking structure	SF	7,800	25.00	195,000
11	Waterproofing to retaining walls	SF	9,150	6.00	54,900
12	Paint to walls	SF	9,150	1.00	9,150
	Element SB total				1,265,025
CL	COLUMNS				
1	Columns to suspended slab	SF	24,500	5.00	122,500
	Element CL total				122,500
UF	UPPER FLOORS				
1	Concrete floor construction	SF	24,500	30.00	735,000
	Element UF total				735,000
SC	STAIRCASES				
1	Concrete staircase incl finishes	FT/R	24	600.00	14,400
	Element SC total				14,400
	Page Total				2,186,925

ITEM DETAILS

D Phase 4 (1 level below grade)

Rates current at March 2005

Item	Description	Unit	Qty	Rate	$
FF	FLOOR FINISHES				
1	Striping to parking structure	SF	24,500	0.75	18,375
	Element FF total				18,375
FT	FITMENTS				
1	Miscellanious metal fabrications	Item			15,000
2	Signage to parking garage	Item			5,000
	Element FT total				20,000
TS	TRANSPORTATION SYSTEMS				
1	Two stop passanger elevator	EA	1	75000.00	75,000
	Element TS total				75,000
PU	SPECIAL PLUMBING SYSTEMS				
1	Sprinkler system	SF	24,500	5.00	122,500
	Element PU total				122,500
VE	VENTILATION				
1	Ventialtion to basement parking	SF	24,500	10.00	245,000
	Element VE total				245,000
LP	ELECTRIC LIGHT AND POWER				
1	Electric light & power to parking garage	SF	24,500	5.00	122,500
	Element LP total				122,500
XR	SITE IMPROVEMENTS				
1	New Curbing	LF	1,064	30.00	31,920
2	New coating surface to existing parking area	SF	23,500	2.00	47,000
3	Traffic coating to parking lots (on top of parking structure)	SF	24,500	8.00	196,000
4	ADA ramp	EA	1	3000.00	3,000
5	Striping to parking areas	SF	48,000	0.20	9,600
6	Concrete Paving	SF	28,151	8.00	225,208
	Page Total				1,116,103

ITEM DETAILS

F Phase 6 (2 levels below grade)

Rates current at March 2005

Item	Description	Unit	Qty	Rate	$
SB	SUBSTRUCTURE				
1	Standard foundations to parking structure	SF	27,844	6.00	167,064
2	Pile foundation system	SF	27,844		Excl.
3	Concrete slab on grade incl base	SF	27,844	6.00	167,064
4	Premium on slab on grade for elevator pit	EA	1	12000.00	12,000
5	Subsoil drainage system	SF	27,844	1.00	27,844
6	Excavations for basement parking	CY	24,751	37.00	915,787
7	Disposal of excavated material from basement parking	CY	24,751	10.00	247,510
8	Lateral support to excavations for basement parking	SF	18,552	25.00	463,800
9	Concrete retaining walls to basement parking	SF	18,552	25.00	463,800
10	Waterproofing to retaining walls	SF	18,552	6.00	111,312
11	Paint on interior side of concrete retaining walls	SF	18,552	1.00	18,552
	Element SB total				2,594,733
UF	UPPER FLOORS				
1	Concrete floor/ramp construction incl columns 12' high	SF	27,844	30.00	835,320
	Element UF total				835,320
SC	STAIRCASES				
1	Concrete staircases incl finishes & railings	FT/R	48	600.00	28,800
	Element SC total				28,800
RF	ROOF				
1	Concrete roof construction incl columns 12' high	SF	27,844	30.00	835,320
2	Waterproofing on concrete slabs (under site improvements)	SF	27,844	6.00	167,064
	Element RF total				1,002,384
	Page Total				4,461,237

ITEM DETAILS

F Phase 6 (2 levels below grade)

Rates current at March 2005

Item	Description	Unit	Qty	Rate	$
FF	FLOOR FINISHES				
1	Road markings on concrete floors	SF	27,844	0.20	5,569
	Element FF total				5,569
FT	FITMENTS				
1	Miscellanious metal fabrications	Item			15,000
2	Signage to parking garage	Item			5,000
	Element FT total				20,000
TS	TRANSPORTATION SYSTEMS				
1	Three stop passanger elevator	EA	1	90000.00	90,000
	Element TS total				90,000
PU	SPECIAL PLUMBING SYSTEMS				
1	Sprinkler & standpipe system to parking garage	SF	55,688	5.00	278,440
	Element PU total				278,440
VE	VENTILATION				
1	Ventilation system to basement parking	SF	55,688	10.00	556,880
	Element VE total				556,880
LP	ELECTRIC LIGHT AND POWER				
1	Electric light and power to parking garage	SF	55,688	5.00	278,440
	Element LP total				278,440
XR	SITE IMPROVEMENTS				
1	Pavement to walkways incl base (on top of parking structure)	SF	7,859	8.00	62,872
2	Landscaping	SF	18,235	5.00	91,175
	Element XR total				154,047
PR	GENERAL REQUIREMENTS				
	Page Total				1,383,376

ITEM DETAILS

P Phase 6 (2 levels below grade)

Rates current at March 2005

Item	Description	Unit	Qty	Rate	$
1	Dewatering of basement floor during construction	SF	27,844	0.70	19,491
2	Margins & Adjustments	Item			2,037,896
	Element PR total				2,057,387
	Total				7,902,000

ITEM DETAILS

G Phase 7

Rates current at March 2005

Item	Description	Unit	Qty	Rate	$
XP	SITE PREPARATION				
1	Remove existing curbs & gutters	LF	1,200		Incl.
2	Remove existing parking surfaces incl curbs & gutters	SF	14,670	1.00	14,670
3	Disposal of demolished material	CY	136	20.00	2,720
	Element XP total				17,390
XR	SITE IMPROVEMENTS				
1	Make good public road at junction	Item			2,000
2	New Curbing to parking lots and roadways	LF	2,130	30.00	63,900
3	New coating surface to existing parking area	SF	42,550	3.00	127,650
4	ADA ramp	EA	1	3000.00	3,000
5	Striping to parking area	SF	42,550	0.75	31,913
6	Concrete Paving	SF	14,802	8.00	118,416
7	Special Paving	SF	929	15.00	13,935
8	Landscaping	SF	13,583	5.00	67,915
	Element XR total				428,729
XK	SITE PLUMBING UTILITIES				
1	Reconfigure sanitary sewer	Item			120,000
2	Reconfigure storm sewer	Item			120,000
	Element XK total				240,000
XE	SITE ELECTRICAL UTILITIES				
1	Reconfigure electrical distribution & lighting	Item			40,000
	Element XE total				40,000
PR	GENERAL REQUIREMENTS				
1	Margins & Adjusments	Item			253,881
	Element PR total				253,881
	Total				980,000

LIHUE CIVIC CENTER MASTTER PLAN PROBABLE COST ESTIMATE

ITEM DETAILS

H Phase 8

Rates current at March 2005

Item	Description	Unit	Qty	Rate	$
XP	SITE PREPARATION				
1	Allowance for site demolitions and relocations	SF	14,800	1.00	14,800
	Element XP total				14,800
XR	SITE IMPROVEMENTS				
1	Allowance for pedestrian paving	SF	14,800	2.00	29,600
2	Allowance for landscaping	SF	14,800	6.00	88,800
	Element XR total				118,400
XK	SITE PLUMBING UTILITIES				
1	Allowance to reconfigure sanitary sewer	Item			10,000
2	Allowance to reconfigure storm sewer	Item			10,000
	Element XK total				20,000
XE	SITE ELECTRICAL UTILITIES				
1	Allowance for electrical	Item			10,000
	Element XE total				10,000
PR	GENERAL REQUIREMENTS				
1	Allowance for margins & adjustments	Item			56,800
	Element PR total				56,800
	Total				220,000