2004-07-08 FONSI
UNIVERSITY OF HAWAII ADVANCED
TECHNOLOGY CENTER & RESEARCH CENTER

Final
Environmental Assessment

PROPOSED ADVANCED TECHNOLOGY CENTER AND ADVANCED TECHNOLOGY RESEARCH CENTER

Prepared for:

June 2004

University of Hawaii
Institute for Astronomy

MUNEKIYO & HIRAGA, INC.

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Preface

The University of Hawaii, Institute for Astronomy, proposes to develop an Advanced Technology Center and an Advanced Technology Research Center and associated improvements on property identified by TMK 2-3-8:38 and 39 (por.) at Kula, Maui, Hawaii.

Since the proposed project involves the use of State funds, an Environmental Assessment (EA) has been prepared as required by Chapter 343, Hawaii Revised Statutes, to document the proposed action's technical characteristics, environmental impacts and alternatives, as well as advance findings and conclusions relative to the significance of the project.

Chapter I

Project Overview

I. PROJECT OVERVIEW

A. PROJECT LOCATION, EXISTING USE, AND LAND OWNERSHIP

The University of Hawaii, Institute for Astronomy (IFA) proposes the development of an Advanced Technology Center (ATC) and an Advanced Technology Research Center (ATRC) on a 3.4-acre site at Kula, Maui, Hawaii. See Figure 1.

The project site is located in the Kulamalu Town Center Subdivision (aka, Kulamalu Commercial Subdivision), which consists of 53.67 acres and is located in the Kulamalu project area. Currently under development, the Kulamalu project area encompasses a mixture of park, school, business, cultural, multi-family residential, single-family residential and public/quasi-public land uses. The project site is presently vacant and was recently mass-graded during site preparation for the Kulamalu Town Center Subdivision.

Identified by TMK 2-3-08:38 and 39 (por.), the project site is also identified by Lot Nos. 15, 16 and 17 of the Kulamalu Town Center Subdivision. See Figure 2. The site is situated within the limits of the State "Urban" district and is designated for "Business/Commercial" uses by the Makawao-Pukalani-Kula Community Plan and "Country Town Business" uses by Maui County zoning.

The project site is bordered by A'Apueo Parkway to the north, Ohi'a Ku Street (under construction) to the east, and undeveloped subdivision lots to the south and west. Access to the site is to be provided by Kula Highway via A'Apueo Parkway and Ohi'a Ku Street.

Land uses in the vicinity of the project site are characterized by undeveloped agricultural parcels, the Maui campus of Kamehameha

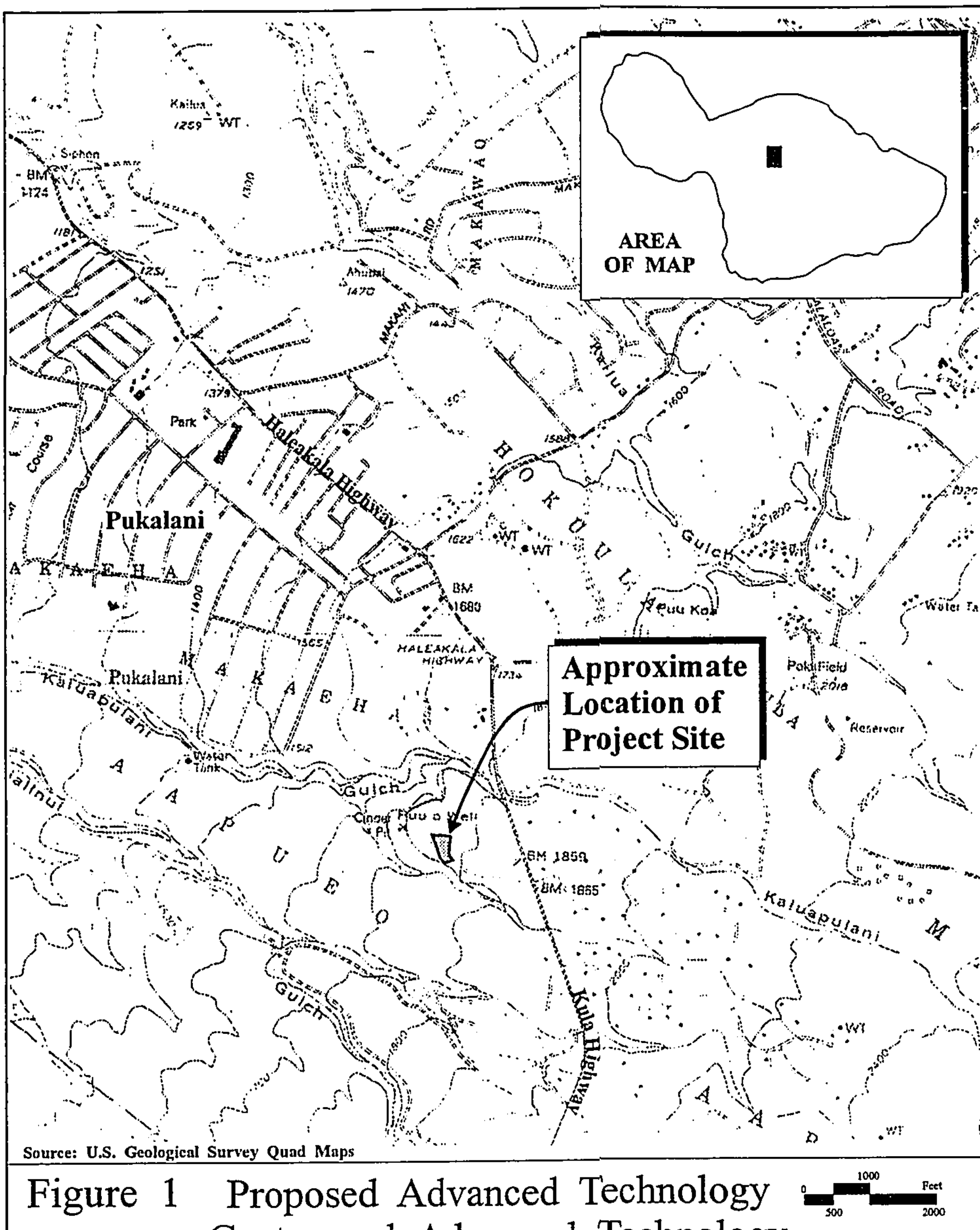

Figure 1 Proposed Advanced Technology Center and Advanced Technology Research Center
Regional Location Map

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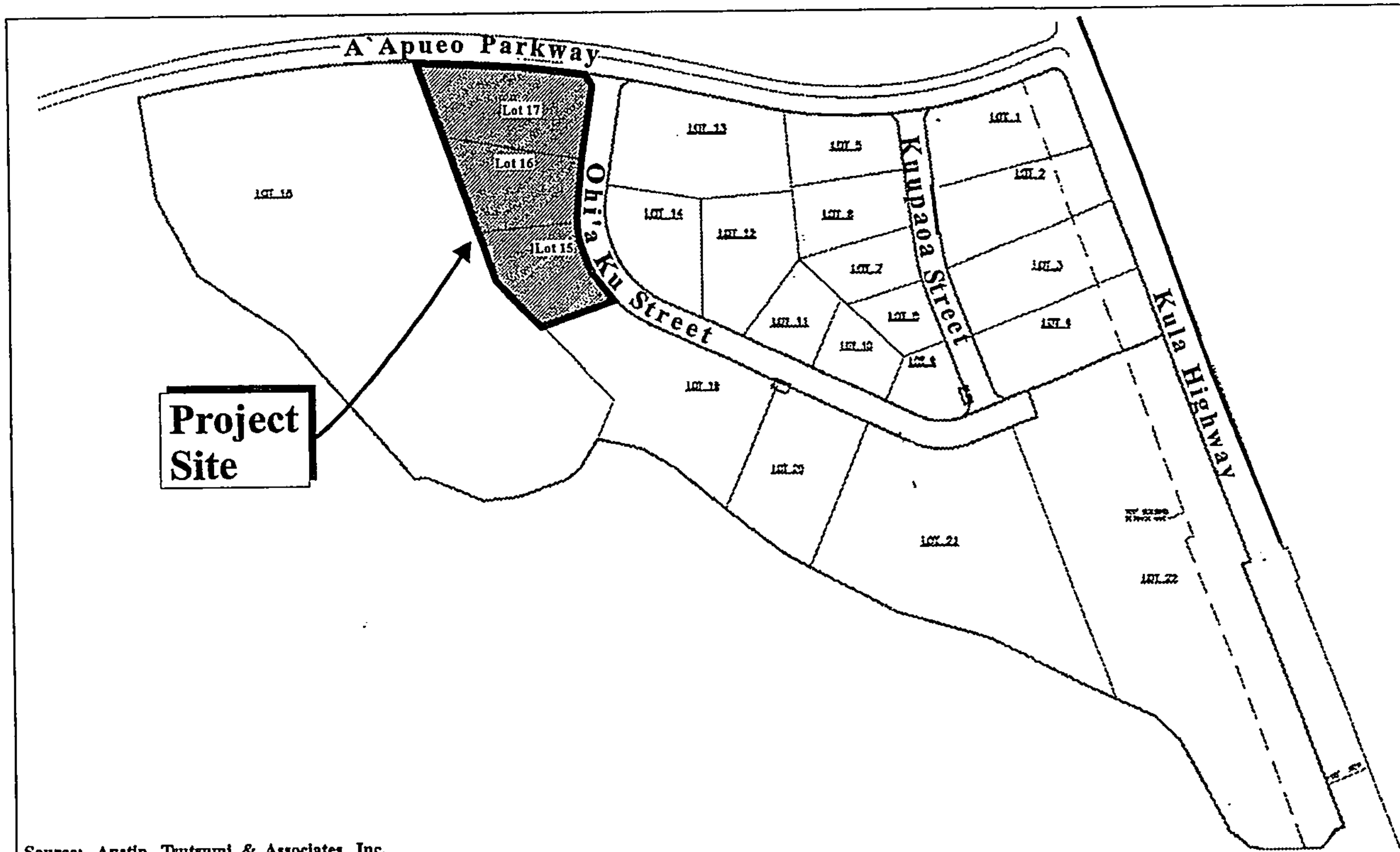

Source: Austin, Tsutsumi & Associates, Inc.

Figure 2

Proposed Advanced Technology Center and Advanced Technology Research Center

Parcel Location Map

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Schools, and Kula 200, an agricultural zoned residential subdivision. Kulamalu Science LLC is the fee simple owner of the subject property.

B. *BACKGROUND*

The Institute for Astronomy (IFA) at the University of Hawaii was founded in 1967 to manage the observatories on Haleakala and Mauna Kea. IFA conducts research into galaxies, cosmology, stars, planets, and the Sun. Its faculty and staff are also involved in astronomy education and in the development of the observatories. IFA has a staff of over 180 persons, including about 45 faculty members. The Institute has an annual budget of $20 million, including $15 million in grants from the federal government.

The IFA operates facilities on the islands of Oahu, Hawaii and Maui. Its main base is in Manoa Valley, Oahu, just north of the main campus. The Institute has close links within the UH-Manoa Department of Physics and Astronomy through the astronomy graduate program, which has about 25 students working for their MS and PhD degrees. IFA faculty also teaches many introductory astronomy courses on the Manoa Campus, reaching some 1,000 undergraduate students annually. In addition, IFA operates the TOPS Program, which is an annual summer astronomy education program for Hawaii and Pacific area high school teachers.

C. *PROPOSED ACTION*

In connection with the development of the project, Lot Nos. 15, 16 and 17 will be consolidated to form a single parcel containing 3.4 acres.

The Advanced Technology Center (ATC) will replace the IFA's existing Waiakoa Laboratory which lacks the space, facilities, and state-of-the-art instrumentation to adequately support the IFA's rapidly growing high-tech research programs.

The ATC, which will be developed on Lot No. 15 and a portion of Lot No. 16, comprises the first phase of the project. See Figure 3 and Appendix "A", Preliminary Development Plans. The approximately 2.0-acre ATC site will contain a 2-story building with about 15,900 square feet of floor area and a 28-stall parking lot, including a loading/service area. The ATC will include spaces for offices, work rooms, storage rooms, equipment rooms, a visitation room, a reception station, a clean room, a machine shop, an electrical room, an observation deck, a component fabrication room, an electronic assembly room, and computer/communication rooms, as well as a lobby, a break room, and restrooms.

The second phase of the project will encompass Lot No. 17 and the remaining portion of Lot No. 16, the development of the Advanced Technology Research Center (ATRC), as well as a two-story annex, a one-story lecture facility (auditorium) and an open air plaza. Refer to Figure 3 and Appendix "A". The ATRC will be a 2-story structure with approximately 34,600 square feet of floor area, while the annex and auditorium will contain approximately 8,300 square feet and 1,200 square feet of floor area, respectively. In addition to providing a 100-stall parking lot and additional space for Phase I ATC uses, the Phase 2 improvements will contain research facilities which will support the IFA's general research programs.

In addition to the Phase 1 and Phase 2 improvements, the proposed action includes the provision of landscaping and parking areas, as well as the installation of utilities. To complement and enhance the Country Town ambiance and character of the Upcountry area, the proposed improvements will be designed in accordance with the Design Standards from the Kulamalu Village Declaration of Covenants, Conditions and Restrictions (DCC&Rs), as well as applicable regulatory standards

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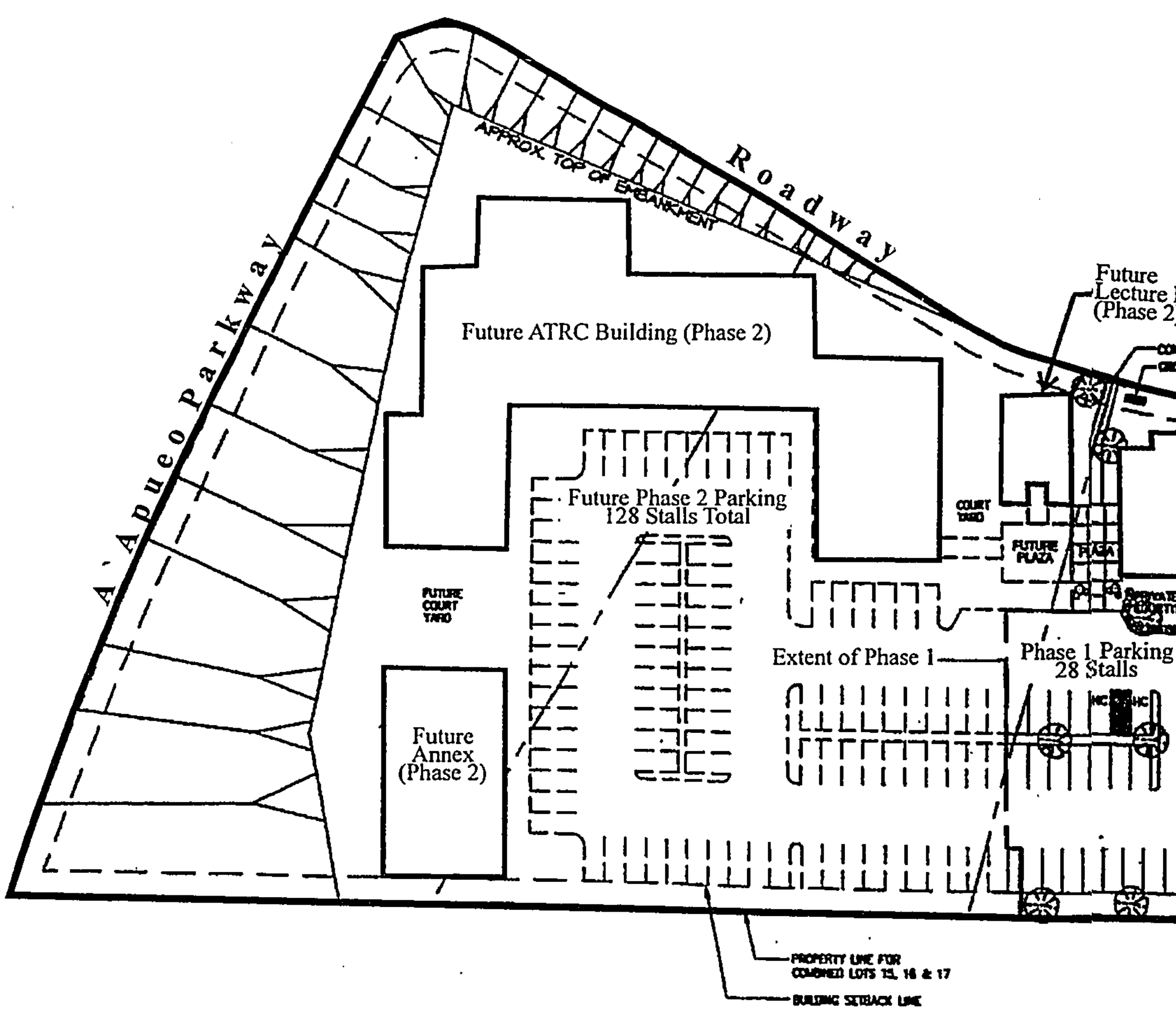

Source: Kober/Hanssen/Mitchell Architects

Figure 3

Proposed Advanced Technology Center an
Advanced Technology Research Center
Preliminary Site Plan

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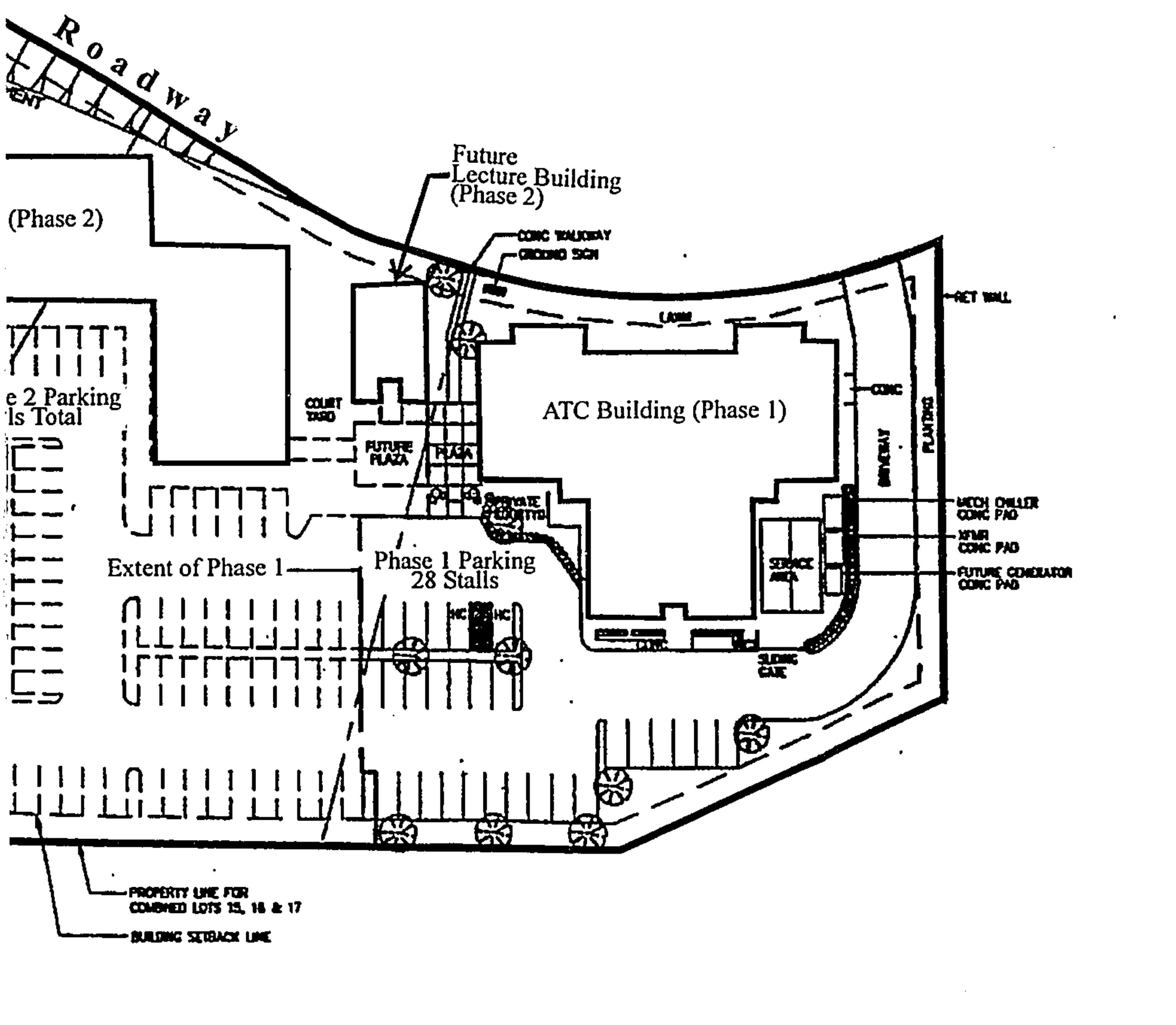

ıced Technology Center and
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liminary Site Plan

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pertaining to off-street parking and handicapped accessibility.

In addition, techniques from the "Guidelines for Sustainable Building Design in Hawaii", including, but not limited to the following, will be utilized for the project.

- Erosion and dust controls are to be incorporated as part of construction contract requirements.
- *Centralized areas will be designated for recycling and* waste diversion.
- Outdoor landscaped areas are being incorporated into the site design.
- Low c glazing or tinted glazing is being specified with window coverings.
- Insulation will be specified as part of the building envelope assembly.
- Task lighting is to be specified at workrooms with lighting controls.
- An energy management system will be specified for monitoring system controls.
- Variable air volume dampers are to be incorporated as part of the mechanical design.
- Variable speed drives (aka, variable fan drives) will be incorporated into the mechanical design.
- The mechanical design will incorporate the use of air-cooled cooling units with appropriately designed motors.
- Fresh air intakes are to be located to prevent inter-mixing with building exhausts.
- Separate HVAC systems will be utilized for office and work areas.
- The energy management system will be utilized during off hours.
- Solar water heating will be incorporated into the design of the facility.
- Low-flow water fixtures will be incorporated where applicable.

The estimated cost of the ATC is approximately $8.6 million. Construction of the ATC is expected to commence in the latter part of 2004, with completion anticipated toward the end of 2005. Based on funding, construction of the Phase 2 improvements is anticipated to be completed in late 2006. While the cost and architectural scheme for the Phase 2 improvements will be developed in connection with its detailed design and engineering phase, the scope of this Environmental Assessment is intended to cover both the Phase 1 and Phase 2 improvements.

Chapter II

Description of the Physical Environment

II. DESCRIPTION OF THE PHYSICAL ENVIRONMENT

A. PHYSICAL SETTING

1. Climate

The project site is located about 1.25 miles south of Pukalani. The Pukalani area is generally cool and equable year round. Average annual rainfall ranges between 40 and 50 inches per year, with most rainfall occurring between the months of October and April. Average temperature ranges from the low 70's in the coolest month to the high 70's in the warmest month.

Like most areas of the islands, the prevailing wind throughout the year is the northeasterly tradewind, which is generally more persistent during the summer than the winter.

2. Topography and Soil Characteristics

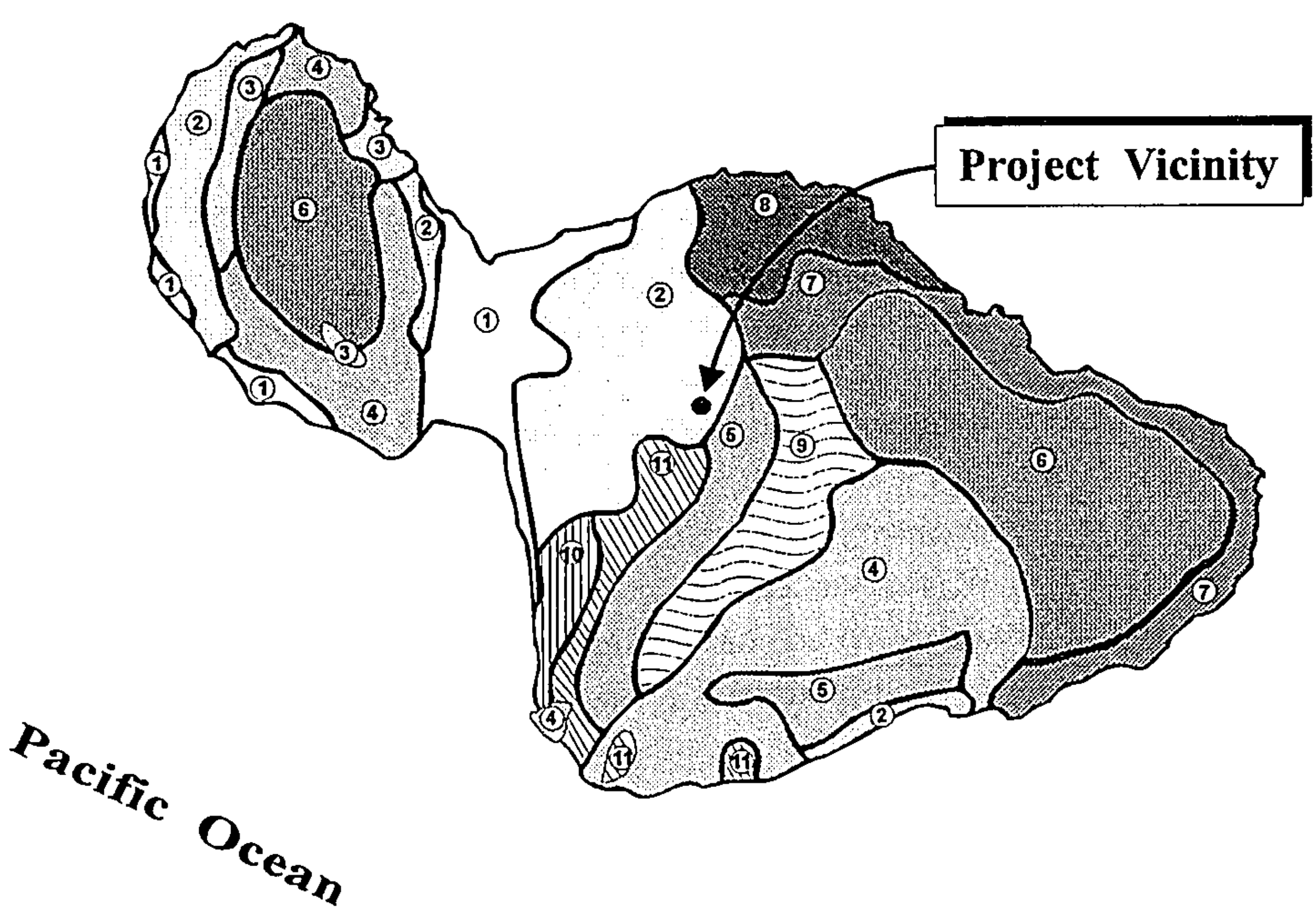
The project site ranges in elevation from 1,774 feet to 1,752 feet above mean sea level. The project site slopes in a northwesterly direction at an approximate grade of three (3) percent.

Underlying the site and surrounding lands are soils belonging to the Waiakoa-Keahua-Molokai association. See Figure 4. This soil association consists of moderately steep, well-drained soils that have a moderately fine textured subsoil located on low uplands. The soils specific to the subject site are Keahua cobbly silty clay loam, 15 to 25 percent slopes (KnaD) and Keahua cobbly silty clay, 7 to 15 percent slopes (KnhC). See Figure 5. A description of these soils is as follows:

Keahua cobbly silty clay loam, 15 to 25 percent slopes (KnaD). On this soil, runoff is medium and the erosion hazard is moderate.

LEGEND

1. Pulehu-Ewa-Jaucas association
2. Waiakoa-Keahua-Molokai association
3. Honolua-Olelo association
4. Rock land-Rough mountainous land association
5. Puu Pa-Kula-Pane association
6. Hydrandepts-Tropaquods association
7. Hana-Makaalae-Kailua association
8. Pauwela-Haiku association
9. Laumaia-Kaipoipoi-Olinda association
10. Keawakapu-Makena association
11. Kamaole-Oanapuka association



Source: USDA Soil Conservation Service

Figure 4 Proposed Advanced Technology Center
and Advanced Technology Research Center
Soil Association Map

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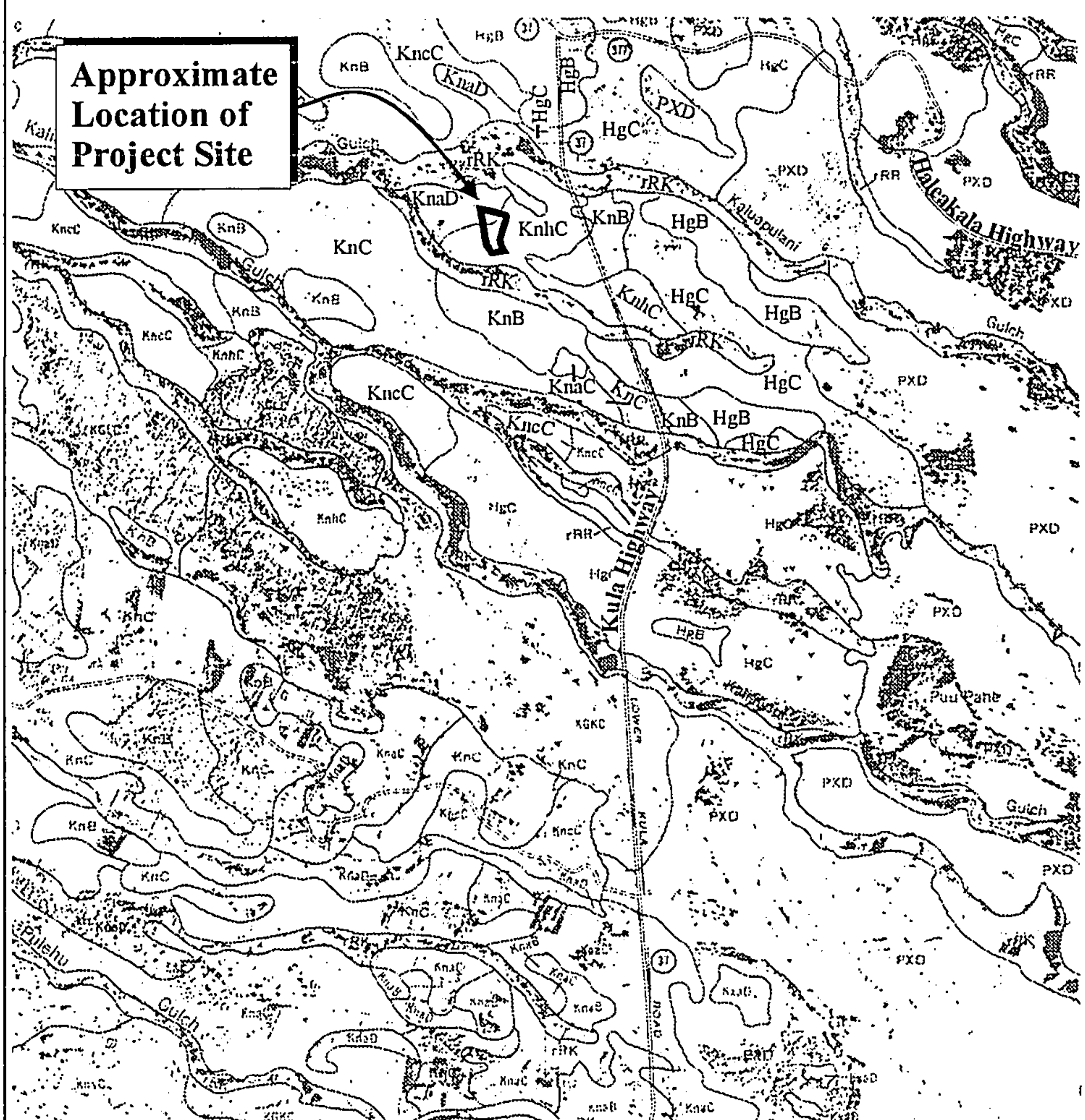

Source: USDA Soil Conservation Service

Figure 5 Proposed Advanced Technology Center and Advanced Technology Research Center

Soil Classifications Map

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Included in mapping were small areas that are not cobbly, as well as a few steep areas.

Keahua cobbly silty clay, 7 to 15 percent slopes (KnhC). Runoff on this soil is slow to medium and the erosion hazard is slight to moderate. Included in mapping were small areas that are 20 to 40 inches deep over soft, weathered basic indigenous rock.

3. ***Flood Hazard***

According to the Federal Emergency Management Agency's Flood Insurance Rate Maps for this area of the island, the project site is situated in an area designated Zone C. See Figure 6. Areas within Zone C are subject to minimal flooding.

4. ***Flora and Fauna***

The project site has been mass-graded and is currently covered with grass and hydromulch from recent site work for the Kulamalu Town Center Subdivision. Prior to grading, the project site was utilized as pasture land and covered by various grasses, as well as low-lying shrubs including guinea grass (Panicum maximum), lantana (Lantana camara L.), sensitive plant (Mimosa pudica), prickly pear (Opuntia ficus-indica), agave (Agave sisalana), and koa-haole (Leucaena leucocephala). Silver oak, eucalyptus and Christmas berry trees were also located at the project site.

Fauna species common to the region include mongoose, chickens, rats, dogs, and cats. Avifauna typically found in the region include mynas, doves, sparrows, and cardinals.

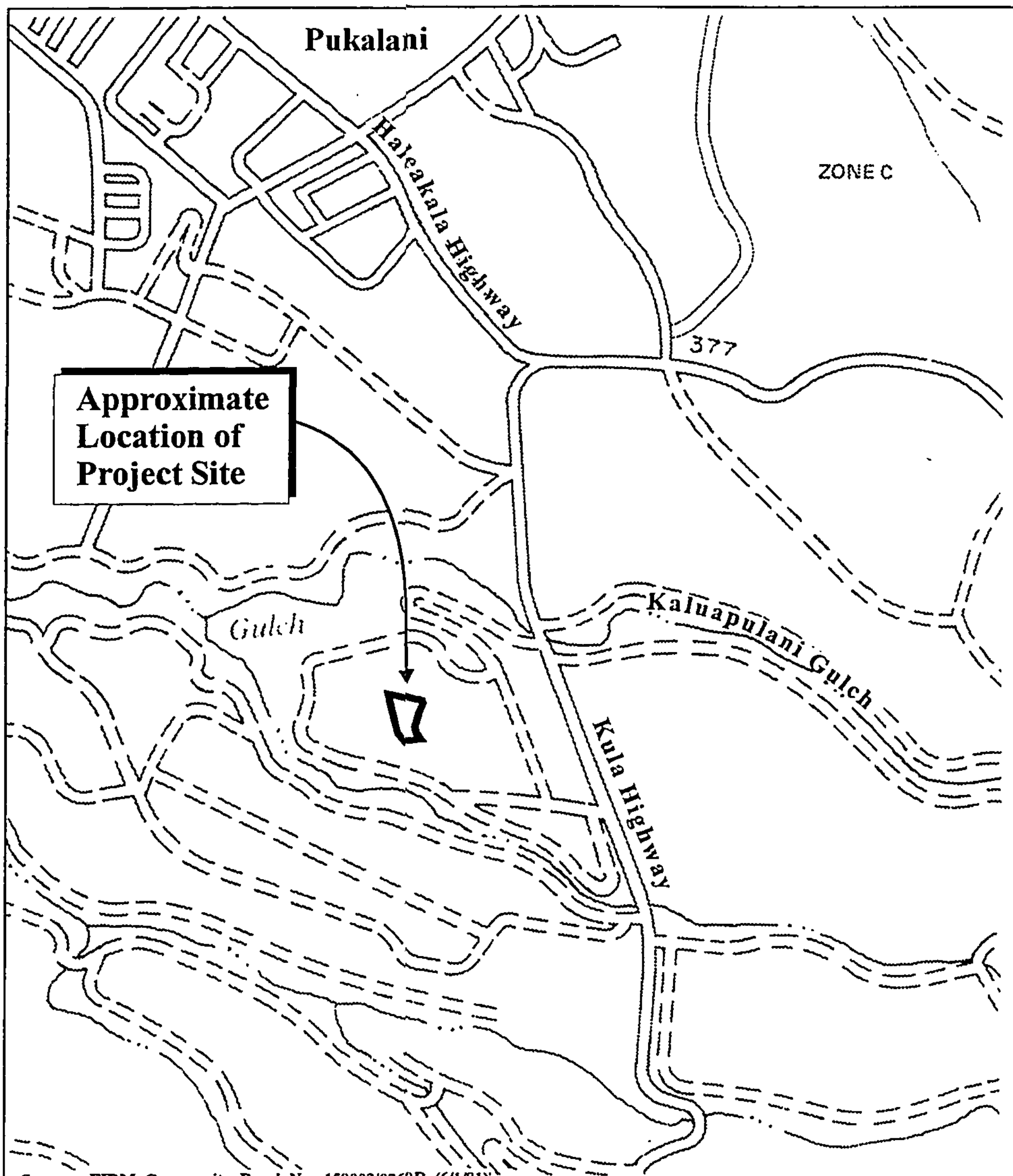

Figure 6 Proposed Advanced Technology Center and Advanced Technology Research Center
Flood Insurance Rate Map

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5. ***Archaeological Resources***

Archaeological surveys of the Kulamalu project area (including the project site) were conducted by Paul H. Rosendahl, Inc. for the Environmental Assessment for the Kulamalu Town Center Subdivision. The archaeological surveys found no archaeological resources at the 3.4-acre project site.

6. ***Air Quality and Noise***

There are no point sources of airborne emissions in the immediate vicinity of the project site. The air quality of the surrounding area is considered good, with existing airborne pollutants attributed primarily to automobile exhaust from the region's roadways.

Surrounding noise levels in the region are characteristic of the rural environment and are considered to be low. Noise levels are primarily affected by traffic and natural (e.g. wind) conditions.

7. ***Scenic and Open Space Resources***

The project site is not located within a scenic view corridor. Haleakala, Maui's central isthmus, the West Maui Mountains, and the islands of Lanai and Kahoolawe comprise scenic resources that are visible from the project site. Open space resources in the region are characterized by the vast expanse of lands encompassed by Haleakala National Park and agricultural lands that lie between areas of existing rural and suburban development.

B. *COMMUNITY SETTING*

1. ***Community Character***

The Makawao-Pukalani-Kula region, also known as Upcountry, is a sprawling agricultural, rural and suburban area on the western slope of Haleakala. Pineapple cultivation, smaller independent farming and cattle ranching are the predominant agricultural activities within the region. The towns of Makawao and Pukalani are the region's main settlement areas and are characterized by a mixture of suburban and rural land uses. Kula's residential settlements reflect a lower density over a larger area with smaller commercial clusters in Pulehu, Waiakoa, and Keokea. The region is also home to many individuals who commute to work in other areas of the island.

2. ***Land Use History***

The lands underlying the project area were originally part of a 160-acre parcel deeded to Aui as Grant 1167. A small triangular wedge on the northwest side of the project area was a portion of Grant 1829, Apana 1 to Keawe. The property was formerly in use as cattle pasture.

There are no known outstanding citations regarding violations of statutes, ordinances, or rules pertaining to the subject property.

3. ***Surrounding Land Uses***

Existing land uses in the vicinity of the project site include low-density residential homes to the south of the gulch that forms the southern border of the Kulamalu Town Center Subdivision. Residential homes are also located to the east of the project site across Kula Highway. The King Kekaulike High School is located approximately 0.5 mile north of the project site while the Maui Campus of Kamehameha Schools is located approximately 0.25 mile west of the project site.

C. SOCIO-ECONOMIC ENVIRONMENT

1. Population

The population of the County of Maui has exhibited relatively strong growth over the past decade with the 2000 population at 128,241, a 27.6 percent increase over the 1990 population of 100,504 (SMS, June 2002). Growth in the County is expected to continue, with the resident population for the year 2010 projected to be 151,269 (SMS, June 2002).

Just as the County's population is estimated to grow, the resident population of the Makawao-Pukalani-Kula Community Plan region has also increased. In 2002, the population of the Makawao-Pukalani-Kula region was 21,571 (SMS, June 2002). The resident population in the region is projected to increase to 25,237 in the year 2010 (SMS, June 2002).

2. Economy

Agriculture and tourism are vital components of Maui's economy. The cultivation of pineapple and sugar cane and the tourist industry provides for much of the island's economic stability.

The Makawao-Pukalani-Kula region provides the backdrop for ranching of cattle and other farm animals by various individuals. There are a number of farms in the Kula region growing products such as cabbages, onions, tomatoes, corn, carnation and protea. Pineapple is also cultivated on fields surrounding the area. Sugar cane cultivation takes place on lower elevation lands extending to the central isthmus.

D. PUBLIC SERVICES

1. Police and Fire Protection

The County of Maui's Police Department is headquartered at its Wailuku Station. The Department consists of several patrol, investigative, and administrative divisions. The department's Upcountry patrol covers the Makawao-Pukalani-Kula region. The nearest police substation is located at the Eddie Tam Gymnasium in Makawao, approximately 2.5 miles away. A new police community service center will be located in the Kulamalu Town Center park.

Presently, fire prevention, suppression and protection for the region is offered by the County's Department of Fire Control Makawao and Kula Stations. The Makawao Station is located on Makawao Avenue, approximately 1.0 mile away from the project site. The Kula Station is located adjacent to Kula Elementary School, approximately 4.2 miles away from the project site.

2. Medical Facilities

Maui Memorial Medical Center, the only major medical facility on the island, services the Makawao region. Acute, general and emergency care services are provided by the approximately 200-bed facility that is located in Wailuku. Medical/dental offices are located in Pukalani and Makawao to serve the Upcountry region's residents.

3. Schools

The State of Hawaii, Department of Education, operates five (5) public schools in Upcountry Maui. They are Makawao Elementary School, Kalama Intermediate School, Pukalani Elementary School, Kula Elementary School, and King Kekaulike High School.

The region is also served by the privately operated Waldorf School, Haleakala School, Seabury Hall, and the Maui Campus of Kamehameha Schools.

4. *Recreational Facilities*

Upcountry Maui is served by numerous recreational facilities offering diverse opportunities for the region's residents. These facilities include the County's Eddie Tam Park/Gym, Pukalani Recreation Center, Keokea Park, Rice Park, Kula Gym, and the Kula Ball Park.

5. *Solid Waste*

Solid waste generated in the Upcountry region are transported to the Central Maui Landfill in Puunene. Outside of Hana, the Central Maui Landfill is the only disposal site on the island of Maui.

E. *INFRASTRUCTURE*

1. *Roadways*

The existing roadway system in the vicinity of the project includes the following roadways and intersections.

a. *Roadways*

Haleakala Highway is a two-lane State Highway that is generally oriented in a northwest-southeast direction. This roadway begins in Kahului in the vicinity of the Triangle Square Commercial project. The highway intersects Old Haleakala Highway and Kula Highway at the Five Trees Junction and terminates at Haleakala National Park.

Haleakala Highway is a three-lane facility from Hana Highway to Makawao Avenue with two (2) lanes in the eastbound (mauka) direction and a single lane in the westbound (makai) direction. Haleakala Highway has a posted speed limit of 45 miles per hour (mph) on the section between Makawao Avenue and Kula Highway. East of the Five Trees Junction, Haleakala Highway has a posted speed limit sign of 30 mph. The State is in the process of widening Haleakala Highway from two (2) to four (4) lanes between Hana Highway and its intersection with the Old Haleakala Highway (western junction). A grassed median will be provided to separate the mauka and makai-bound travel lanes and the existing traffic signal system at the highway and fire break road junction will be relocated. In addition, a new traffic signal system will be installed at the highway's intersection with Haliimaile Road. The completion of this widening project is anticipated to occur in the 2005 timeframe.

Kula Highway is a two-lane, rural, arterial, State highway that connects the Pukalani area with the Ulupalakua area. Kula Highway is generally oriented in the north-south direction and begins in Pukalani at the Five Trees Junction of Old Haleakala Highway and Haleakala Highway. In the vicinity of the project site, Kula Highway has a posted speed limit of 45 mph.

Old Haleakala Highway is a two-lane, County collector road that serves the Pukalani area. Old Haleakala Highway is generally oriented in a northwest-southeast direction and provides a parallel route to Haleakala Highway through the town of Pukalani. Old Haleakala Highway begins at its intersection with Haleakala Highway approximately 0.5 mile east of Haliimaile Road and terminates at the Five Trees Junction at Haleakala Highway and Kula Highway. Old Haleakala Highway has a posted speed limit of 35 mph.

Makani Road is a two-lane, County collector road that serves Pukalani town and Makawao town. Makani Road is generally oriented in the north-south direction, originating within Pukalani at its intersection with Old Haleakala Highway, and extending northeasterly to eventually intersect with Makawao Avenue.

Pukalani Street is a two-lane, County collector roadway serving residential and commercial areas in Pukalani town. Pukalani Street is generally oriented in the north-south direction, originating at its intersection with Old Haleakala Highway, and extending southwesterly to the Pukalani County Club Golf Course.

Within the study area, Makawao Avenue is a two-lane, County collector road that serves Pukalani town and Makawao town. Makawao Avenue is generally oriented in the north-south direction, originating at Pukalani from its intersection with Old Haleakala Highway and terminating across from Kaupakulua Road north of its intersection with Baldwin Avenue.

Loha Street is a two-lane, County collector roadway serving residential areas in Pukalani. Loha Street is a continuation of Makawao Avenue south of its intersection with Old Haleakala Highway.

A'Apueo Parkway is a two-lane, east-west, private collector roadway with a posted speed limit of 20 mph. (At the time of writing this report, it is signed as part of an active construction site not open to the public.) A'Apueo Parkway serves as the only access to the Maui Campus of Kamehameha Schools and the Kulamalu project area.

b. ***Intersections***

Haleakala Highway/Old Haleakala Highway (western junction) A contraflow operation on Haleakala Highway is implemented during the weekday AM peak period of traffic. When the contraflow operation is in effect, all traffic on the Haleakala Highway eastbound approach is forced to exit via right turn onto Old Haleakala Highway and right-turns from the Old Haleakala Highway approach onto Haleakala Highway are prohibited. As a result of the AM contraflow operation, there is no conflicting traffic for the northbound to westbound left-turn movement from the Old Haleakala Highway approach.

Haleakala Highway/Makani Road is a "cross" intersection with traffic on Makani Road controlled by a stop sign.

Haleakala Highway/Makawao Avenue is a signalized "cross" intersection.

Haleakala Highway/Kula Highway/Old Haleakala Highway (Five Trees Junction) is a signalized "cross" intersection. Haleakala Highway is the southbound and westbound approaches of the intersection (Haleakala Highway makes a 90 degree turn at this intersection). Kula Highway is the northbound approach and Old Haleakala Highway is the eastbound approach at this intersection.

Old Haleakala Highway/Pukalani Street is a signalized "tee" intersection with Pukalani Street as the stem.

Old Haleakala Highway/Makawao Avenue/Loha Street is a signalized "cross" intersection.

Kula Highway/King Kekaulike High School (KKHS) Driveway/Residential Driveway is an unsignalized "cross" intersection.

Kula Highway/A'apueo Parkway is an unsignalized "tee"-intersection with A'apueo Parkway as the stop sign-controlled stem.

Access to the project site is currently provided from Kula Highway by A'Apueo Parkway. Ku'upaoa Street and Ohi'a Ku Street, which are presently under construction, are roadways which branch off from A'Apueo Parkway on the south and provide internal circulation and access for lots within the Kulamalu Town Center Subdivision. The project site is located along Ohi'a Ku Street. Situated within a 60-foot right-of-way, Ohi'a Ku Street is designed with a curb-to-curb pavement width of 40 feet.

2. ***Water***

The Makawao-Haiku system is supplied by surface water runoff collected on the windward slopes of Haleakala. This water is collected and conveyed by the Wailoa irrigation ditch and tunnel system, owned and maintained by the East Maui Irrigation Company (EMI), with a capacity of 190 million gallons per day (mgd). The County of Maui, Department of Water Supply (DWS) has an agreement with EMI to draw up to 12 mgd at Kamole Weir forebay.

This water is then treated by the Kamole Weir Water Treatment Plant (WTP), owned and operated by DWS. Kamole Weir WTP is located northeast of Haliimaile near the intersection of Baldwin Avenue and Haliimaile Road. It has a 300,000 gallon concrete treated water storage tank at a floor elevation of 1,114 feet above mean sea level (msl), and can treat up to 8 mgd in compliance with EPA Safe Drinking Water standards.

Water from the Kamole Weir WTP is transmitted by pumping to Makawao through a 24-inch diameter force main along Baldwin Avenue and Olinda Road. Storage is provided by the 0.3 and 2.0 million gallon Pookela tanks at floor elevations of 1,808 and 1,830 feet msl, respectively.

Water is then pumped via an 18-inch force main to the 0.5 mg Maluhia Tank at 2,051 feet msl.

There is a 12-inch main running along Olinda Road, Hanamu Road and Haleakala Highway from the Maluhia Tank to the King Kekaulike High School.

Via an agreement with the Board of Water Supply, a well and related improvements were constructed at Huluhulunui Gulch near Kaupakalua to provide domestic water and fire protection for the Kulamalu project area. A new 1.0 million gallon (MG) off-site reservoir was constructed above King Kekaulike High School to provide water storage for the Kulamalu project area, including the project site. To convey water from the 1.0 MG reservoir to the Kulamalu project, approximately 2,300 lineal feet of new 12-inch waterline was installed along Kula Highway.

A Preliminary Engineering Report has been prepared for the proposed project. See Appendix "B". As noted in the report, existing 12-inch ductile iron County waterlines are located within A'Apueo Parkway and Ohi'a Ku Street. There are existing fire hydrants surrounding the project site. Water service (3/4-inch laterals) is available for each of the lots in the Kulamalu Town Center Subdivision.

3. *Wastewater*

There are no County wastewater treatment facilities serving the Kula-Pukalani area. Other than a private wastewater treatment plant which serves Pukalani Terrace residents, wastewater disposal is accommodated via cesspools or individual wastewater treatment systems such as septic tanks. The plant currently provides treated wastewater to the Pukalani Terrace Country Club golf course for irrigation purposes.

An existing sewer system is located within Ohi'a Ku Street and A'Aupueo Parkway. Refer to Appendix "B". Sewer service laterals are available for each of the lots in the Kulamalu Town Center Subdivision. Wastewater generated by the project will be accommodated by the privately owned Pukalani wastewater treatment plant via a capacity allocation that was granted to the developer of the Kulamalu project area.

4. *Drainage*

As indicated in the Preliminary Engineering Report for the proposed project, onsite stormwater runoff within the project site generally sheet flows in a northwesterly direction towards Lot 17 and eventually flows towards an existing underground drainage system within A'Apueo Parkway. Refer to Appendix "B". In addition, there is an existing underground drainage system that lies within Ohi'a Ku Street.

Based on a 50 year - 1 hour storm recurrence interval, existing onsite runoff is estimated at approximately 1.32 cubic feet per second (cfs) and 3.16 cfs for Phases 1 and 2, respectively.

5. *Electrical, Telephone, and CATV*

The distribution system for electrical, telephone, and cable television (CATV) services in the region are situated in the Kula Highway right-of-way and are provided by Maui Electric, Verizon Hawaii, and Hawaiian Cablevision, respectively.

Chapter III

Potential Impacts and Mitigation Measures

III. POTENTIAL IMPACTS AND MITIGATION MEASURES

A. PHYSICAL SETTING

1. Geographic Features

No significant impacts to topography and soils are anticipated. Given that the project site has already been mass graded, future grading activities will be limited to the proposed building sites, access and internal roads, and parking areas.

Two (2) intermittent natural drainageways are located in the vicinity of the project site. Kaluapulani Gulch lies beyond the project site to the north, while an unnamed gulch is situated beyond the site to the south. The proposed project is not expected to have an adverse effect on the existing physical environment.

In addition, the subject property is not located within a flood plain, tsunami zone, or erosion-prone area, nor is it situated on geologically hazardous lands or located by an estuary, fresh waters, or coastal waters. The Flood Insurance Rate Maps for the island reflect that the project site falls within Zone C, an area of minimal flooding. The site also lies beyond the limits of tsunami inundation as indicated by Civil Defense maps for Maui. In addition, the soils underlying the subject property are well-drained and characterized by slow to moderate runoff.

There are no wetlands, streams, or other water bodies on the subject property. The proposed project will not involve the discharge of any fill material into Kaluapulani Gulch or any of its tributaries.

2. ***Flora and Fauna***

There are no rare, threatened, or endangered species of flora or fauna on the project site. The project site was formerly utilized as pasture land and was previously occupied by various grasses and lowlying scrub vegetation. Inasmuch as the project site has been recently mass graded and is currently vacant and undeveloped, the use of the site for the proposed improvements is not expected to have an adverse effect on flora and fauna in the vicinity.

3. ***Archaeological Resources***

As previously indicated, the project site was formerly utilized as pasture and has been recently disturbed in connection with the mass grading for the Kulamalu Town Center Subdivision. In addition, the archaeological surveys that were conducted of the Kulamalu project area did not locate any archaeological sites or cultural artifacts on the project site. In the event significant cultural deposits or human burials are encountered during construction of the project, work will cease in the area of the find and the find will be protected from further disturbance. The State Historic Preservation Division will then be promptly notified to determine appropriate mitigation measures.

4. ***Cultural Impact Assessment***

A Cultural Impact Assessment has been prepared for the proposed project. See Appendix "D".

a. ***Historical Context***

As noted in the assessment, the project site is situated within the ahupua'a of Kula and is located in the 'ili of 'A'apueo. Situated on a high, elevated plain within the ahupua'a, the 'ili is nestled along ridges and bordered by gulches that would have protected this area and made it a safe place to live. The assessment notes that there are various translations for 'A'apueo. One translation is "the owl's will", while another reflects the a'a rock topography of the area. Most sources, however, believe that 'A'apueo was named after a female deity who once resided in the area.

As noted in the Cultural Impact Assessment, the vegetation in the Kula and 'A'apueo areas do not flourish as generously as in other ahupua'a on Maui. Due to its remote geographic location, the Hawaiian archipelago evolved with myriad species of flora and fauna, some of which are unique and found nowhere else in the world. Plant life in the Kula area include the 'Iliahi (santalum freyecinetianum) or sandalwood, which was traditionally used to scent kapa cloth and occasionally used to make 'ukeke (a musical bow), the only traditional Hawaiian stringed instrument. The leaves and wood of the 'Iliahi were also used medicinally, often in combination with 'awa and other woods. One type of 'Iliahi (with a red flower and of the lanaiense variety) is an endangered species and is found only on Lana'i and in East Maui where there are about 100 plants on the south slope of Haleakala . Other medicinal plants from this area include the 'Ahina Kuahiwi (gunnera petaloidea), also known as the Ka'ape'ape or 'Ape'ape, and the Mau'u Laili (sisyrinchium acre), a crawling grass (native iris) found in the highest elevations of the Kula area. The Mau'u La'ili is used to treat skin disorders. The durable wood of the golden-flowered lacy Mamane or Kolomona tree (sophora chrysophylla) was utilized to make o'o (digging sticks), house poles, and holua sleds. Due to the arid conditions in Kula, kalo or taro was not a suitable plant crop. To supplement the need for wetland kalo, the 'uala (sweet potato) was grown as an alternative. Sweet potato was just as stable and healthy as kalo and required less water to bear fruit, while kalo grew best in fields of fresh running water. The 'ulu (artocarpus incisus) or breadfruit was also cultivated as a dietary supplement for kalo. Another plant found in the Kula area is the 'a'ali'i (dodonaea) bush. This hardwood native shrub is indigenous to the islands and grows well in dryer climates. The 'a'ali'i is found at elevations of up to 8,000 feet and in wind-swept, open country. It can also be found in the gulches and area surrounding the project site. One important plant used to construct thatched homes was Pili grass (heterogon contortus), which used to grow in arid and dusty conditions. The native Hawaiians would group dried clumps of Pili grass together to form a waterproof dwelling.

The Cultural Impact Assessment indicates that there is little recorded information about wildlife in the Kula and 'A'apueo areas. It is noted, however, that foreign plants, feral animals, and fowl have invaded these areas and resulted in the destruction of much of the area's natural habitat. As indicated in the assessment, the native owl seldom takes flight in the area. The common barn owl (native to North America), which tends to be more aggressive and has caused a depletion of other native bird and plant species, primarily inhabits the region. The assessment also notes that wild deer, that were introduced within the past 30 years, have caused erosion and crop damage to farms and surrounding areas in Kula.

As noted in the Cultural Impact Assessment, the word Kula translates to "plain" in the Hawaiian language. While this may not fully describe the topography within this ahupua'a, much of its landscape is arid and farming was limited to plant crops that could tolerate hot days and cold evenings. Although the landscape in Kula has changed considerably over the past few centuries, the climate has remained constant. The assessment also notes that many of the culturally significant sites, such as heiau and ahu, no longer exist due to the "paniolo" (Hawaiian cowboy) age. During this era, much of the land was cleared for cattle ranching activities and heiau and ahu were plundered without regard for its significance to the area. Later, during the late 1950s and 1960s, population growth in the Kula region further affected data recovery and contributed to the lack of information on culturally significant sites.

To obtain a range of cultural perspectives, interviews were held with several individuals with knowledge of and familiarity with the project area. A summary of some of these interviews follows.

(1) ***<u>Frances Lamadora</u>***

Ms. Lamadora stated that she was born in Hali'imaile, and when she was a teenager, her family moved to Pukalani. Her home is across the gulch (Makawao area) of the project site. She related that when she was growing up in the area, they used to walk through the gulches, and through the project area. They used to see all kinds of "Hawaiian things" in the gulch, but always remembered what her parents taught them. They were not to touch things, or to be "niele (curious) when they saw anything that belonged to the ancient culture of Hawai'i.

She recalls that her "Tutu" (grandparent) used to tell that the real name for the area that they lived in was Maka'eha. Her grandmother used to scold her because they tried to shoot the owls that flew in the area with a slingshot. Her grandmother told her the owl was their Aumakua (family god), so she should not harm the owl.

She remembers that there was a Heiau (Hawaiian temple) above her home, but she was always told by her parents to stay away from the "stone pile". She does not remember anything about the area being studied, except for the high grass that was growing in the area of the project.

(2) ***<u>Hokulani Holt-Padilla</u>***

Ms. Holt-Padilla related that she is aware of the project area, and is familiar with the past cultural history of the area. She did not know of any archaeological sites within the study area. However, she is aware of the gulches and ancient Heiau in other areas surrounding the project site.

(3) ***<u>Charles Maxwell</u>***

Charles Maxwell was born in Lahaina, Maui in 1937. Three years later, Charles and his family moved to Kula where he grew up and was raised. From birth until kindergarten, Charles spoke only Hawaiian since that was the only language his parents spoke at home. Through public schooling, Charles learned the English language.

As the youngest family member, Charles's parents taught him much about Hawaiian cultural practices, including religious ceremonies for reinterring ancient Hawaiian remains. From the age of 19, Charles handled the reinterment of inadvertently discovered ancient remains.

As a teen, Charles would go into Haleakala Crater to hunt and camp. During one of his trips, he discovered a cave containing an akua ka'ai (sacred image). This experience later led to his becoming a member of the State Cave Task Force which advances the knowledge of burial caves and of their sacredness to the Hawaiian people.

Later, as a young man, Charles attended Maui Community College and, in 1968, received a degree in police science. For 15 years, Charles served as an officer with the Maui Police Department on the island of Molokai. In 1974, Charles retired due to injuries sustained in the line of duty.

After being injured, Charles did a lot of research on all phases of the Hawaiian culture, including oral history interviews with kupuna (elders). He also became very active in community affairs associated with native Hawaiian rights and culture. For example, Charles served as the first president of the A.L.O.H.A. (Aboriginal Lands of Hawaiian Ancestry) Association and journeyed to Washington D.C. to seek reparations from the federal government for the overthrow of the Hawaiian monarchy. In 1976, Charles organized and led the first native Hawaiian occupation of Kahoolawe to protest the use of the island as a bombing range by the U.S. Navy. Charles was also instrumental in establishing guidelines for subsistence practices for the island based on ancient Hawaiian methods of fishing. In 1991, when a tiger shark fatally attacked a woman swimming at Olowalu, Charles spearheaded efforts to successfully halt a shark eradication program on the basis that the shark was the "amakua" (personal god) to some Hawaiian families. Charles currently serves as a Hawaiian cultural representative on the State Shark Task Force.

Insofar as the project area is concerned, Charles mentioned that 'A'apueo Parkway was named after the female owl-goddess who lived in the area. Charles wrote a chant about 'A'apueo which was performed during one of the annual Merrie Monarch Festivals in Hilo.

In pre-contact times, Charles mentioned that lands in the project area served as the site for the observance of the Makahiki, an annual event held during the months of January and February at which time taxes were collected and festivities were held. Charles also mentioned that gulches in the area once contained adze factories and that evidence suggests that streams flowed within these gulches at one time.

During post-contact times, Charles indicated that the land *mauka* of the project site (across Kula Highway) was known for having the best sweet potato patches on the island. The sweet potatoes were planted to supply prospectors with food during the California gold rush. Later, with the advent of cattle ranching, Charles mentioned that the indigenous plants and trees in the area were wiped out and the forest line moved higher up the slopes of Haleakala. Without the forests to capture rain clouds and facilitate precipitation, stream flows in the gulches ceased.

In terms of cultural resources, Charles indicated that he is not aware of, nor has he observed, any cultural, gathering, or subsistence practices occurring on lands within the project area. In light of the foregoing, it was noted that the proposed project is not expected to have an adverse impact on native Hawaiian cultural resources, practices, and beliefs.

As indicated by the Cultural Impact Assessment, while much of Kula today is still largely zoned for agricultural uses, the area has become suburban in character. As noted by the assessment, much of Kula's natural and indigenous landscape barely exists. The thinking then should be to reverse the impact on the lands, such as planting shrubs native to the area, desecrate the land as little as possible, and stop using tactics such as those of the "paniolo" era. The assessment also notes that more cautious approaches to certain areas are solutions to the vitality of our

Hawaii. In addition, the assessment indicates that the proposed project will not affect the fauna, flora or endangered species, because they have already been impacted by prior agricultural disturbances which occurred in the project area. Furthermore, because of prior disturbance to the site, no cultural or archaeological properties were found for preservation. In the 3.4-acre project area, no evidence of past or present use for Hawaiian cultural practices, resources, or beliefs were found in the study area. The assessment notes that as there are no areas of impact from the proposed construction on this site, mitigation measures are not necessary. The project area does not pose an impact on access rights by Native Hawaiians that would require the use of this area for cultural and spiritual purposes. In light of the foregoing, and based on an evaluation of the preceding informant interviews, the proposed action is not expected to have an adverse impact on native Hawaiian cultural beliefs, practices, resources or gathering rights.

5. ***Air Quality***

Air quality impacts are anticipated to be confined to construction related activities. Proper emission control devices and dust control measures, such as regular watering, are anticipated to minimize potential impacts.

In the long term, project-related vehicular traffic will generate automotive emissions. However, these emissions are not expected to adversely impact local and regional air quality conditions.

6. ***Noise***

Ambient noise conditions will be affected over the short term by construction activities. Construction tools and equipment, such as power tools, bulldozers, front-end loaders and materials-carrying trucks, are anticipated to be the dominant sources of noise. Proper equipment and vehicle maintenance are anticipated to minimize noise levels. Equipment mufflers or other sound attenuating devices may also be utilized as needed. In addition, all exterior construction work will be limited to normal daylight hours.

No significant adverse long-term impacts are anticipated to result from development of the project.

7. ***Scenic and Open Space Resources***

The proposed project is not expected to have an adverse effect on scenic and open space resources in the area. To complement and enhance the Country Town atmosphere of the Upcountry area, the proposed buildings will be designed in accordance with the Design Standards from the Kulamalu Village CC&Rs dated November 2000. The proposed improvements will integrate low-rise structures, landscaping and parking areas to provide facilities which not only address spatial requirements but are compatible with the surrounding environment.

The project site is not part of a scenic corridor. The proposed improvements will not encroach into view corridors and affect views from inland vantage points. The improvements will be designed and landscaped to complement and enhance the visual character of the surrounding area.

8. ***Use of Chemicals and Fertilizers***

Use of herbicides on the project site will generally be limited to the initial plant establishment period. Pesticides are anticipated to be used only as a treatment and not as a preventive measure. As a treatment, application usage will be minimal. In addition, plant selection for the project will be based on hardiness, drought tolerance, pest resistance as well as aesthetic concerns.

Nitrogen/Phosphorus/Potash mixed fertilizers are anticipated to be applied to lawn areas, groundcover, and flowering shrubs. With proper irrigation management practices, leaching of fertilizers should be negligible.

The Resource Conservation and Recovery Act (RCRA) and the Hazardous and Solid Waste Amendments of 1984 set standards and requirements for the management of solid and hazardous wastes. RCRA regulations (42 USC 6901 et seq. 40 CFR Parts 260 to 272) define hazardous waste as any discarded material that is solid, liquid or gaseous and that "because of its quantity, concentration or physical, chemical or infectious characteristics may contribute to an increase in mortality or serious illness or the environment when improperly managed."

40 CFR Part 261 defines hazardous wastes and also provides lists of hazardous wastes from specific and nonspecific sources. Materials that are neither solid nor hazardous wastes and small quantities are exempt from all or part of the regulations.

It is unknown at the present time what, if any, hazardous products will be used during routine facility maintenance and operations activities. The IFA will comply with the Resource Conservation and Recovery Act, as amended. Any defined hazardous waste will be handled by an authorized Transport Storage and Disposal Facility.

No adverse effects on surface, underground and marine water resources are anticipated.

9. ***Agriculture***

As previously indicated, the project site is located on lands in the *State Urban District and is also designated for* Business/Commercial and Country Town Business uses by the Makawao-Pukalani-Kula Community Plan and Maui County zoning, respectively.

The project site was formerly utilized for cattle grazing. There are approximately 71,800 acres of agricultural land within the community plan region. The use of 3.4 acres of urban designated land for the proposed project is not expected to have an adverse impact on agriculture, nor is it anticipated to affect lands that are available for agricultural use.

B. ***COMMUNITY SETTING***

1. ***Surrounding Uses***

The proposed project is consistent with land uses surrounding the site. The 3.4-acre project site is located in the Kulamalu Town Center Subdivision, a mixed use development which contains 19.41 acres of land (including the project site) designated for business uses.

In addition, the project site and the other subdivision lots designated for business uses are set aside for Business/Commercial and Country Town Business uses by the

Makawao-Pukalani-Kula Community Plan and Maui County zoning, respectively.

The proposed project is in consonance with the land uses permitted for the site, and is also compatible with the business designated uses of the adjacent parcels.

C. *SOCIO-ECONOMIC ENVIRONMENT*

1. *Population and Economy*

On a short-term basis, the project will support construction and construction-related employment.

In the long term, the proposed project will support the economy through its contribution of taxes and salaries, as well as through the purchases of goods and services from local businesses.

D. *PUBLIC SERVICES*

1. *Police, Fire and Medical Services*

The project site is located within the service area limits for police, fire, and emergency medical services. The proposed project is not anticipated to affect the service area limits or affect the service capabilities of police, fire, and emergency medical operations.

2. *Recreational and Educational Facilities*

The proposed project will not have an adverse effect on existing recreational or educational resources, nor will it generate a demand for additional parks or schools.

It should also be noted that within the project area, there are no known traditional beach and mountain access trails.

3. *Solid Waste*

On a short-term basis, construction activities will require the disposal of construction-related solid waste. The IFA will work with the contractor to minimize the amount of solid waste generated during the construction of the project. As appropriate, a private construction waste disposal facility will be utilized by the contractor for the disposal of construction waste materials. In the long term, solid waste collection for the project will be provided by a commercial waste disposal service.

E. *INFRASTRUCTURE*

1. *Roadways*

Access from Kula Highway to the project site area is presently provided via A'Apueo Parkway. From A'Apueo Parkway, primary access to the site will be provided via Ohi'a Ku Street, while secondary access will be provided by Ku'upaoa Street. Both roadways are currently under construction. Appropriate traffic control measures will be utilized during the construction period to minimize impacts to traffic flow and provide for the safe passage of vehicles.

A Traffic Impact Analysis Report has been prepared for the proposed project. See Appendix "C". The TIAR uses accepted methods for analyzing signalized and unsignalized intersections, as set forth by the 2000 Highway Capacity Manual.

Conclusions

The following are the conclusions of the traffic study for Year 2005 with Phase 1 of the project.

a. ***Year 2005 with Phase 1***

- Development of Phase 1 of the project could potentially generate approximately 31 and 24 total trips during the AM and PM peak hours of traffic, respectively.
- The trip generation estimate for Phase 1 is conservative as it assumes worst-case conditions for the peak hours of traffic. IFA staff will likely enter and exit at various times of the day based on viewing conditions at the summit rather than at a fixed time.
- Approximately two-thirds of the estimated Phase 1 traffic should be considered as "diverted or re-routed existing traffic" since Phase 1 is a relocation of the existing IFA Waiakoa Laboratory in Kula. The analysis is conservative as project-generated traffic was added to base year volumes without accounting for the diversion.
- Traffic operations will be similar to Base Year 2005 conditions.

The following are the conclusions of the traffic study for Year 2006 with Phase 1 and Phase 2 of the project.

b. ***Year 2006 with Phase 1 and Phase 2***

- Development of the project (Phase 1 and Phase 2) could potentially generate approximately 97 and 91 total trips during the AM and PM peak hours of traffic, respectively.
- Traffic operations will be similar to Base Year 2006 conditions.
- The Kula Highway/A'apueo Parkway intersection will be operating near capacity. Any additional traffic at this intersection may require eastbound double left-turn on A'apueo Parkway.

Recommendations

The following are the recommendations of the traffic study without project-generated traffic:

a. ***Without Project-Generated Traffic***

Base Year 2005

- Install traffic signal systems at the Haleakala Highway/Old Haleakala Highway (western intersection) and Haleakala Highway/Makani Road intersections. Interconnect and synchronize these traffic signal systems with the existing traffic signals along Haleakala Highway at Makawao Avenue and the Five Trees Junction. Synchronization of these traffic signal systems may provide additional gaps in traffic on Kula Highway for turning movements on the minor approaches at the unsignalized Kula Highway/KKHS Driveway/Residential Driveway intersection.

- Install a traffic signal system at the Kula Highway/Aapueo Parkway intersection.

Base Year 2006

- Widen Haleakala Highway to four (4) lanes, with two (2) lanes in each direction, from the Haleakala Highway/Old Haleakala Highway (western intersection) to west of the Five Trees Junction.

- At the Haleakala Highway/Old Haleakala Highway (western intersection), provide a westbound acceleration lane on Haleakala Highway to receive northbound left-turns from Old Haleakala Highway. Provide traffic signal system phasing such that the westbound through traffic on Haleakala Highway and northbound left-turn traffic proceed through the intersection simultaneously. This would enable vehicles turning left from northbound Old Haleakala Highway onto westbound Haleakala Highway to accelerate and merge with traffic on Haleakala Highway further west of the intersection. The westbound through vehicles would not be controlled by the traffic signal system and would be allowed to proceed continuously.

- Revise the traffic signal system at the Haleakala Highway/Makawao Avenue intersection to provide a protected left-turn phase for traffic on the minor street approaches.
- Adjust the traffic signal timing at the Five Trees Junction to be coordinated with the revised traffic signal system at the Haleakala Highway/Makani Road intersection.

The following are the recommendations of the traffic study with project-generated traffic:

b. ***With Project-Generated Traffic***

Year 2005 with Phase 1

There are no specific recommendations of the traffic study with traffic generated by Phase 1 of the project.

Year 2006 with Phase 1 and Phase 2

There are no specific recommendations of the traffic study with traffic generated by Phase 2 of the project.

2. ***Water***

Domestic water and fire flow for the region is provided by the County of Maui, Department of Water Supply's (DWS) public water system.

A new water system will be installed within the project site to provide water service for the project. The Preliminary Engineering Report for the proposed project indicates that preliminary water demand estimates reflect an average daily demand of approximately 2,200 gallons per day (gpd) and 6,200 gpd for Phases 1 and 2, respectively. Refer to Appendix "B".

The proposed project is not anticipated to adversely impact regional water service. Source, storage, and transmission facilities for the Kulamalu project area have been completed by its developer. Requirements and calculations for fire, domestic, and irrigation water service and use, as well as connection to the County's water system will be coordinated with the DWS as part of the project's building permit application review and approval process. In addition, water system improvements will be coordinated with the DWS to ensure that adequate supply is available at the time of development.

3. ***Wastewater***

The Preliminary Engineering Report for the proposed project indicates that a new sewer system will be installed within the project site to provide sewer service for the project. Refer to Appendix "B". Preliminary wastewater contributions are calculated at approximately 2,000 gpd (average daily demand) and 5,500 gpd for Phases 1 and 2, respectively.

The proposed project is not expected to adversely impact the County's wastewater system, as there is no County wastewater collection system in the vicinity of the project site. See Appendix "B". Wastewater from the project will be accommodated by the privately operated Pukalani Terrace wastewater treatment facility.

4. Drainage

The Preliminary Engineering Report for the proposed project notes that the project site will require excavation and embankment for the proposed buildings and parking lot for Phase 1. Refer to Appendix "B". In addition, the site will be graded to maintain the existing northwesterly drainage pattern and accommodate the future buildings and parking lot for Phase 2. An off-site retention basin will be installed to accommodate the post-development flow. New onsite drainage system improvements will involve the installation of grated drain inlets, manholes and underground drainlines.

Post-development flow from the project site is calculated at approximately 4.46 cfs and 7.25 cfs for Phases 1 and 2, respectively. Hydrology calculations are based on a 50 year - 1 hour storm recurrence interval. The proposed drainage system for the project site will be designed to maintain the predevelopment discharge rate and prevent adverse effect to the downstream properties.

Appropriate mitigative measures and Best Management Practices (BMPs) will be utilized during construction to minimize the effects of soil erosion and loss. In addition, all necessary drainage system improvements will be designed in accordance with the "Rules for the Design of Storm Drainage Facilities in the County of Maui" to ensure that the proposed drainage system will not adversely affect downstream and adjacent properties. In addition, a detailed drainage report and erosion control plan, including BMPs, will be submitted to the County of Maui, Department of Public Works and Waste Management for review and approval, in connection with the processing of building permit applications for the project.

5. *Electrical, Telephone and CATV*

Electrical, telephone, and cable television services for the proposed project will be coordinated with Maui Electric, Verizon Hawaii, and Hawaiian Cablevision, respectively.

F. *CUMULATIVE AND SECONDARY IMPACTS*

The proposed project is not expected to impact population parameters or result in an increased demand for public services and facilities, nor is it expected to create significant new demands for housing or infrastructure. During the short term, the project will benefit the economy, either directly and/or indirectly, through the payment of wages, salaries, benefits and taxes for employees involved in construction and construction-related jobs. In the long term, project employees will support the local economy through the contribution of taxes, and the purchase of goods and services from local businesses. In addition, the project will provide the support and infrastructure for advances in the fields of science and technology, as well as enable the IFA research faculty and staff to develop work practicum, apprentice and mentor programs with Maui Community College and the future University of Hawaii-Maui Campus. This would provide Hawaii students with job opportunities in the high-tech industry without having to leave the islands.

Chapter IV

Relationship to Governmental Plans, Policies and Controls

IV. RELATIONSHIP TO GOVERNMENT PLANS, POLICIES AND CONTROLS

A. *STATE LAND USE DISTRICTS*

The State Land Use Law, Chapter 205, Hawaii Revised Statutes (HRS), is intended to preserve, protect, and encourage the development of lands in the State for uses which are best suited to the public health and welfare for Hawaii's people. All lands in the State are classified into four (4) land use districts by the State Land Use Commission: "Urban", "Agricultural", "Conservation", and "Rural".

The project site is situated within the State Urban district. See Figure 7. The proposed action is compatible with, and permitted within the State Urban district.

B. *HAWAII STATE PLAN*

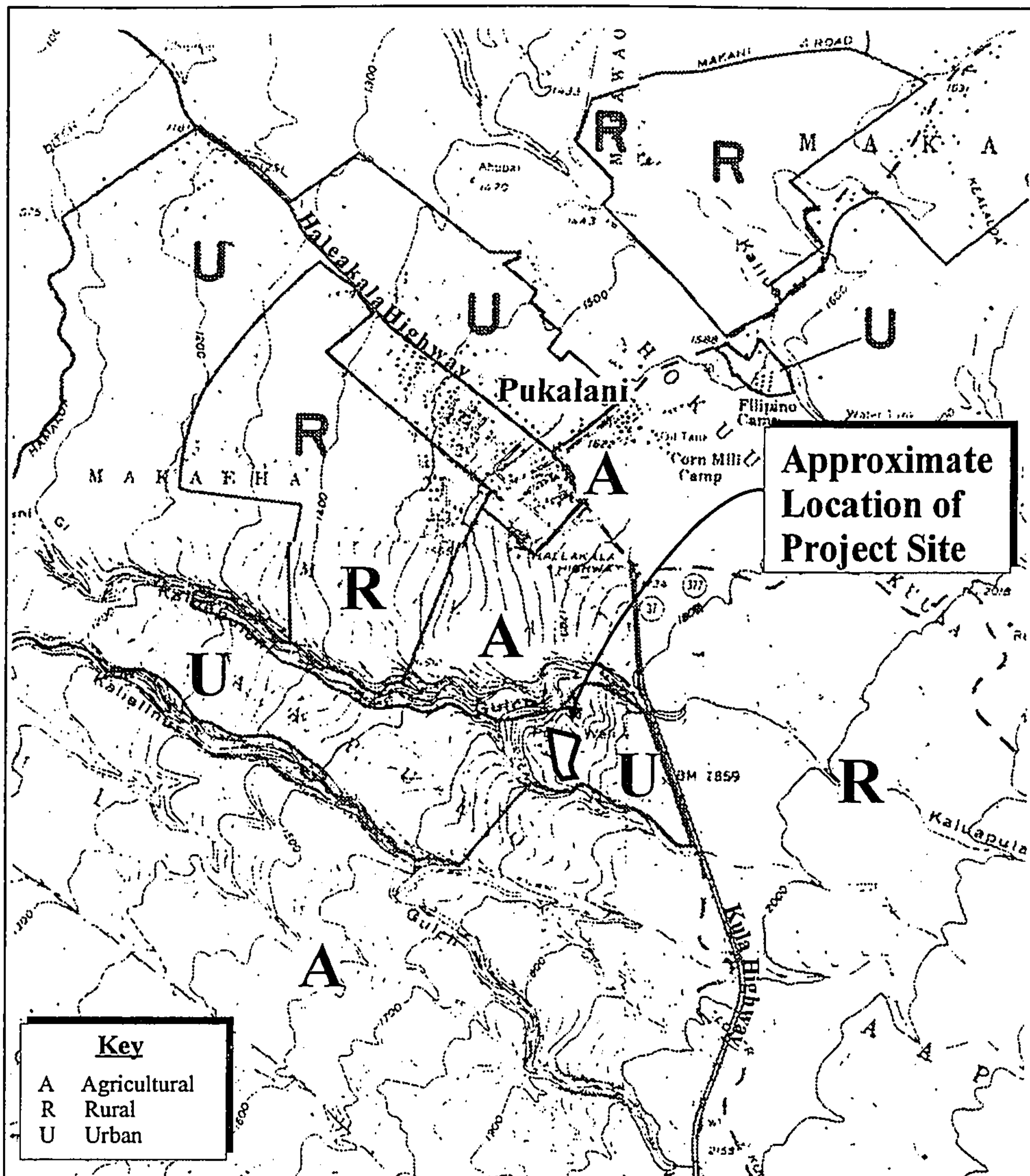
Chapter 226, HRS, also known as the Hawaii State Plan, is a long-range comprehensive plan which serves as a guide for the future long-term development of the State by identifying goals, objectives, policies, and priorities, as well as implementation mechanisms.

The proposed action is consistent with the following State Plan objective and policies.

ECONOMY

Objective:

- A steadily growing and diversified economic base that is not overly dependent on a few industries.



Source: State Land Use Commission District Boundary Maps.

Figure 7 Proposed Advanced Technology Center and Advanced Technology Research Center
State Land Use District Classifications

0 500 1000 2000 Feet

MUNEKIYO & HIRAGA, INC.

Prepared for: University of Hawaii, Institute for Astronomy

Policies:

- Expand existing markets and penetrate new markets for Hawaii's goods and services.
- Promote federal use of local commodities, services and facilities available in Hawaii.
- Enhance and promote Hawaii's role as a center for international relations, trade, finance, services, technology, education, culture and the arts.
- Promote Hawaii's geographic, environmental, social and technological advantages to attract new economic activities into the State.
- Develop, promote and support research, educational and training programs that will enhance Hawaii's ability to attract and develop economic activities of benefit to Hawaii.

C. MAUI COUNTY GENERAL PLAN

The Maui County General Plan (1990 Update) sets forth broad objectives and policies to help the long-range development of the County. As stated in the Maui County charter, "*The purpose of the General Plan is to recognize and state the major problems and opportunities concerning the needs and development of the County and the social, economic, and environmental effects of such development and set forth the desired sequence, patterns and characteristics of future development.*"

The proposed action is in consonance with the following General Plan objectives and policies.

LAND USE

Objective:

- To use the land within the County for the social and economic benefit of all the County's residents.

ECONOMY

Objective:

- To provide an economic climate which will encourage controlled expansion and diversification of the County's economic base.

Policies:

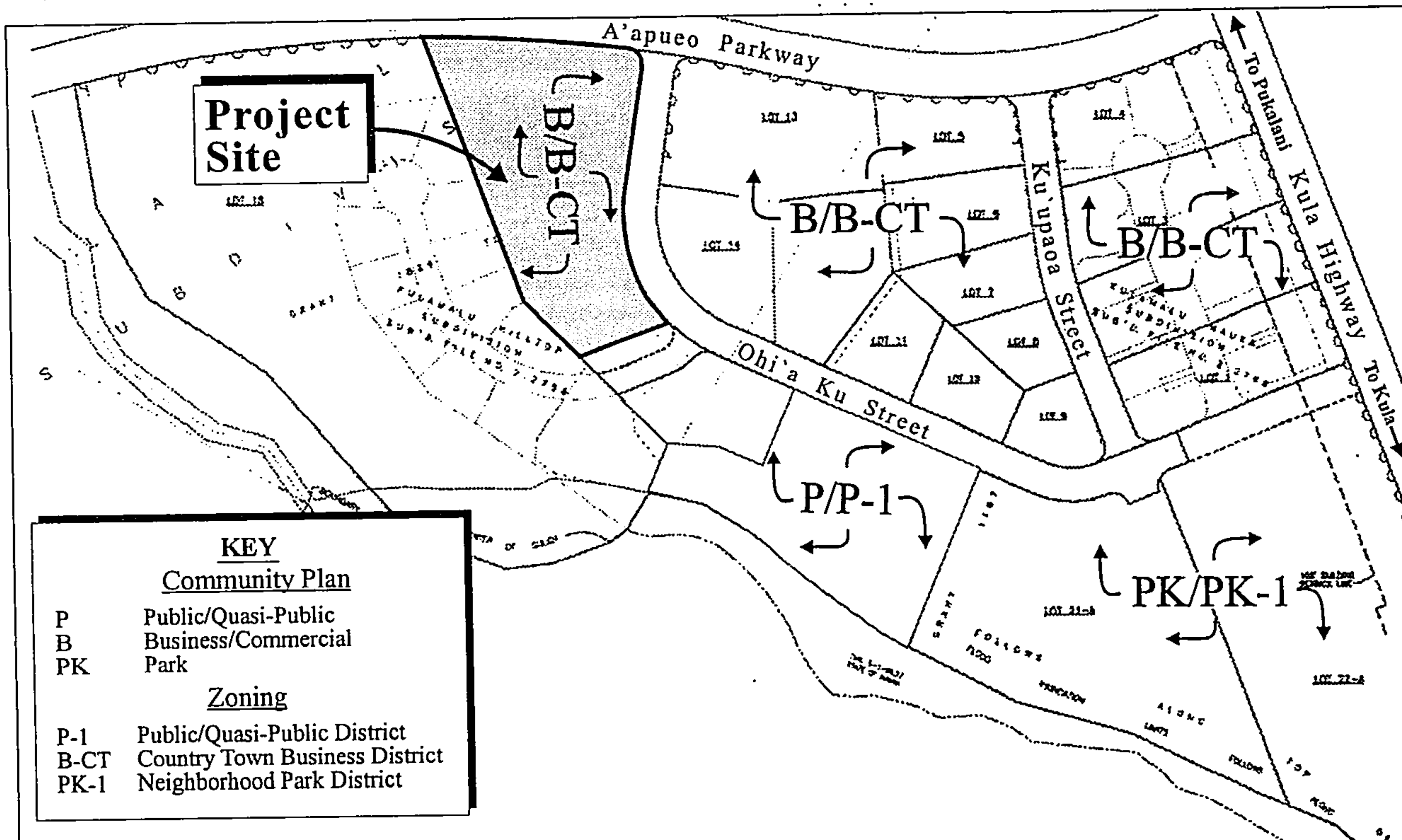
- Maintain a diversified economic environment compatible with acceptable and consistent employment.
- Support programs, services and institutions which provide economic diversification.

D. MAKAWAO-PUKALANI-KULA COMMUNITY PLAN

The project site is located within the Makawao-Pukalani-Kula Community Plan region, one (1) of nine (9) community plan regions established in the County of Maui. Planning for each region is guided by the respective community plans, which are designed to implement the Maui County General Plan. Each community plan sets forth desired land use patterns, as well as goals, objectives, policies and implementing actions for development within the region.

The lands underlying the project site are designated for "Business/Commercial" uses by the Makawao-Pukalani-Kula Community Plan (1996). See Figure 8. In December 1997, the Maui County Council approved amendments to the community plan land use map to reflect minor changes concerning the location of land uses within the project area.

From a community plan land use perspective, the proposed project is in keeping with the uses designated for the site by the Makawao-Pukalani-



KEY

Community Plan

P	Public/Quasi-Public
B	Business/Commercial
PK	Park

Zoning

P-1	Public/Quasi-Public District
B-CT	Country Town Business District
PK-1	Neighborhood Park District

Source: Austin, Tsutsumi & Associates, Inc.

Figure 8 Proposed Advanced Technology Center and Advanced Technology Research Center
Community Plan and Zoning Designations

NOT TO SCALE

Prepared for: University of Hawaii, Institute for Astronomy

MUNEKIYO & HIRAGA, INC.

Kula Community Plan and is in consonance with the following goals, objectives and policies of the community plan.

Goals:

- A stable and diverse economic environment which supports a level of community prosperity in order to provide social services and environmental amenities and which respects the region's rural and agricultural lifestyle, open space and natural resources.

- The maintenance and enhancement of Upcountry's unique and diverse rural land use character with sensitivity to existing land use patterns, natural resource values and economic and social needs of the region's residents.

- Recognition and preservation of the unique design characteristics of the Makawao, Pukalani and Kula communities in order to enhance Upcountry's man-made environment.

  Objectives and Policies:

  - Encourage commercial building scales which are compatible with the low-scale character of existing commercial structures.

  - Preserve the unique characteristics of all of the Upcountry towns by recognizing and respecting architectural styles as described in the Country Town Design Guidelines.

  - Enforce a two-story or 35-foot height limitation throughout the region, except for public/quasi-public uses such as auditoriums, gymnasiums and fire stations.

E. ***ZONING***

Permitted uses and performance standards are promulgated by Chapter 19 of the Maui County Code (MCC) pertaining to zoning.

The project site is zoned for Country Town Business District uses by the County of Maui. Refer to Figure 8. The intent of this zoning district is to establish development standards for businesses in the rural communities.

Principal permitted uses within the Country Town Business District include buildings and premises utilized by government agencies; amusement activities and printing establishments within enclosed buildings; automobile service stations; auditoriums and theaters; bakeries; businesses, financial and professional offices; commercial retail; personal service; and eating and drinking establishments; educational, trade and certain types of personal skills schools; fitness centers and dancing studios; hardware, feed and garden stores; laundromats; music studios; parking lots; religious, benevolent, philanthropic societies and civic organizations; bed and breakfast homes (subject to MCC provisions); and accessory uses and structures necessary to facilitate the establishment of principal permitted uses.

The proposed project is in concert with the County Town Business District zoning for the project site.

F. *COASTAL ZONE MANAGEMENT OBJECTIVES AND POLICIES*

The Hawaii Coastal Zone Management Program (HCZMP), as formalized in Chapter 205A, HRS, establishes objectives and policies for the preservation, protection and restoration of natural resources of Hawaii's coastal zone.

As set forth in Chapter 205A, HRS, this section addresses the project's relationship to applicable coastal zone management considerations.

1. ***Recreational Resources***

Objective: Provide coastal recreational opportunities accessible to the public.

Policies:

a. Improve coordination and funding of coastal recreational planning and management; and

b. Provide adequate, accessible, and diverse recreational opportunities in the coastal zone management area by:

   (i) Protecting coastal resources uniquely suited for recreational activities that cannot be provided in other areas;

   (ii) Requiring replacement of coastal resources having significant recreational value including, but not limited to, surfing sites, fishponds, and sand beaches, when such resources will be unavoidably damaged by development; or requiring reasonable monetary compensation to the state for recreation when replacement is not feasible or desirable;

   (iii) Providing and managing adequate public access, consistent with conservation of natural resources, to and along shorelines with recreational value;

   (iv) Providing an adequate supply of shoreline parks and other recreational facilities suitable for public recreation;

   (v) Ensuring public recreational uses of county, state, and federally owned or controlled shoreline lands and waters having recreational value consistent with public safety standards and conservation of natural resources;

   (vi) Adopting water quality standards and regulating point and non-point sources of pollution to protect, and where feasible, restore the recreational value of coastal waters;

   (vii) Developing new shoreline recreational opportunities, where appropriate, such as artificial lagoons, artificial beaches, and artificial reefs for surfing and fishing; and

   (viii) Encouraging reasonable dedication of shoreline areas with recreational value for public use as part of discretionary approvals or permits by the land use commission, board of land and natural resources, and county authorities; and crediting such dedication against the requirements of Section 46-6, HRS.

Response: The proposed action is not anticipated to impact coastal recreational opportunities or affect existing public access to the shoreline. The project is designed to provide needed space and state-of-the art instrumentation, as well as clean room facilities to adequately support the IFA's rapidly growing high-tech research programs, and accordingly, is not a direct generator of, nor does it create a demand for, regional recreational resources.

2. ***Historical/Cultural Resources***

Objective: Protect, preserve and, where desirable, restore those natural and manmade historic and prehistoric resources in the coastal zone management area that are significant in Hawaiian and American history and culture.

Policies:

a. Identify and analyze significant archeological resources;
b. Maximize information retention through preservation of remains and artifacts or salvage operations; and
c. Support state goals for protection, restoration, interpretation, and display of historic resources.

Response: The project site, which was previously utilized as pasture, has recently been disturbed in connection with mass grading for the Kulamalu Town Center Subdivision. The archaeological surveys of the Kulamalu project area did not locate any archaeological sites or cultural artifacts at the project site. Should human remains be inadvertently discovered during earth moving activities, work shall cease at once in the immediate area of the find, and the find shall be protected from further disturbance.

The State Historic Preservation Division shall also be immediately notified and procedures for the treatment of inadvertently discovered human remains shall be followed pursuant to Chapter 6E, HRS.

3. *Scenic and Open Space Resources*

Objectives: Protect, preserve and, where desirable, restore or improve the quality of coastal scenic and open space resources.

Policies:

a. Identify valued scenic resources in the coastal zone management area;
b. Ensure that new developments are compatible with their visual environment by designing and locating such developments to minimize the alteration of natural landforms and existing public views to and along the shoreline;
c. Preserve, maintain, and, where desirable, improve and restore shoreline open space and scenic resources; and
d. Encourage those developments that are not coastal dependent to locate in inland areas.

Response: The proposed improvements will be designed and landscaped in accordance with applicable regulatory standards to ensure visual compatibility with the surrounding land uses. The proposed action is not contrary to the objectives and policies for scenic and open space resources.

4. *Coastal Ecosystem*

Objective: Protect valuable coastal ecosystems, including reefs, from disruption and minimize adverse impacts on all coastal ecosystems.

Policies:

a. Exercise an overall conservation ethic, and practice stewardship in the protection, use, and development of marine and coastal resources;

b. Improve the technical basis for natural resource management;

c. Preserve valuable coastal ecosystems, including reefs, of significant biological or economic importance;

d. Minimize disruption or degradation of coastal water ecosystems by effective regulation of stream diversions, channelization, and similar land and water uses, recognizing competing water needs; and

e. Promote water quantity and quality planning and management practices that reflect the tolerance of fresh water and marine ecosystems and maintain and enhance water quality through the development and implementation of point and nonpoint source water pollution control measures.

Response: The proposed action is not expected to adversely impact coastal ecosystems. Drainage system improvements will be designed in accordance with applicable regulatory standards to ensure that there are no adverse effects to adjacent or downstream properties.

In addition, appropriate erosion control measures will be implemented to minimize the effects of stormwater runoff during construction of the project and to ensure that coastal ecosystems are not adversely impacted.

5. Economic Use

Objective: Provide public or private facilities and improvements important to the State's economy in suitable locations.

Policies:

a. Concentrate coastal dependent development in appropriate areas;

b. Ensure that coastal dependent development such as harbors and ports, and coastal related development such as visitor facilities and energy generating facilities, are located, designed, and constructed to minimize adverse social, visual, and environmental impacts in the coastal zone management area; and

c. Direct the location and expansion of coastal dependent developments to areas presently designated and used for such developments and permit reasonable long-term growth at such areas, and permit coastal dependent development outside of presently designated areas when:
   (i) Use of presently designated locations is not feasible;
   (ii) Adverse environmental effects are minimized; and
   (iii) The development is important to the State's economy.

Response: The proposed project is consistent with the goals of the Makawao-Pukalani-Kula Community Plan, which guides growth and development in the region.

6. ***Coastal Hazards***

Objective: Reduce hazard to life and property from tsunami, storm waves, stream flooding, erosion, subsidence and pollution.

Policies:

a. Develop and communicate adequate information about storm wave, tsunami, flood, erosion, subsidence, and point and nonpoint source pollution hazards;
b. Control development in areas subject to storm wave, tsunami, flood, erosion, hurricane, wind, subsidence, and point and nonpoint pollution hazards;
c. Ensure that developments comply with requirements of the Federal Flood Insurance Program; and
d. Prevent coastal flooding from inland projects.

Response: The project site falls within Zone C, an area of minimal flooding. Drainage improvements will be designed in accordance with the Drainage Standards of the County of Maui to ensure that the project will not adversely affect downstream and adjoining properties from the effects of flooding and erosion.

7. ***Managing Development***

Objective: Improve the development review process, communication, and public participation in the management of coastal resources and hazards.

Policies:

a. Use, implement, and enforce existing law effectively to the maximum extent possible in managing present and future coastal zone development;

b. Facilitate timely processing of applications for development permits and resolve overlapping of conflicting permit requirements; and

c. Communicate the potential short and long-term impacts of proposed significant coastal developments early in their life cycle and in terms understandable to the public to facilitate public participation in the planning and review process.

Response: This Environmental Assessment has been prepared for public review in compliance with Chapter 343, HRS, and Chapter 200 of Title 11, Administrative Rules, *Environmental Impact Statement Rules.*

In addition, all aspects of development will be conducted in accordance with applicable State and County requirements. Opportunity for review of the proposed action is offered through the various regulatory permit processes.

8. ***Public Participation***

Objective: Stimulate public awareness, education, and participation in coastal management.

Policies:

a. Promote public involvement in coastal zone management processes;

b. Disseminate information on coastal management issues by means of educational materials, published reports, staff contact, and public workshops for persons and organizations concerned with coastal issues, developments, and government activities; and

c. Organize workshops, policy dialogues, and site-specific mediations to respond to coastal issues and conflicts.

Response: Opportunities for public awareness, education, and participation in coastal management are provided through the environmental review process.

9. *Beach Protection*

Objective: Protect beaches for public use and recreation.

Policies:

a. Locate new structures inland from the shoreline setback to conserve open space, minimize interference with natural shoreline processes, and minimize loss of improvements due to erosion;

b. Prohibit construction of private erosion-protection structures seaward of the shoreline, except when they result in improved aesthetic and engineering solutions to erosion at the sites and do not interfere with existing recreational and waterline activities; and

c. Minimize the construction of public erosion-protection structures seaward of the shoreline.

Response: At its closest point, the subject property is located approximately 8.0 miles from the shoreline and is not anticipated to impact shoreline processes.

10. *Marine Resources*

Objective:

Promote the protection, use, and development of marine and coastal resources to assure their sustainability.

Policies:

a. Ensure that the use and development of marine and coastal resources are ecologically and environmentally sound and economically beneficial;
b. Coordinate the management of marine and coastal resources and activities to improve effectiveness and efficiency;
c. Assert and articulate the interests of the State as a partner with federal agencies in the sound management of ocean resources within the United States exclusive economic zone;
d. Promote research, study, and understanding of ocean processes, marine life, and other ocean resources in order to acquire and inventory information necessary to understand how ocean development activities relate to and impact upon ocean and coastal resources; and
e. Encourage research and development of new, innovative technologies for exploring, using, or protecting marine and coastal resources.

Resources: Best Management Practices (BMP's) will be incorporated during construction to support the policies of effective management of marine resources.

It is noted that the project site is not located within the boundaries of the County of Maui's Special Management Area.

Chapter V

Summary of Adverse Environmental Effects Which Cannot Be Avoided

V. SUMMARY OF ADVERSE ENVIRONMENTAL EFFECTS WHICH CANNOT BE AVOIDED

The proposed development will result in unavoidable construction-related impacts as described in Chapter III, Potential Impacts and Mitigation Measures.

Potential effects include noise-generated impacts occurring from site preparation and construction activities. In addition, there may be temporary air quality impacts associated with dust generated from construction activities, and exhaust discharged by construction equipment. It should be noted, however, that these impacts are expected to be minimized through the implementation of the appropriate mitigative measures identified in Chapter III.

The proposed project is not anticipated to create any significant, long-term adverse environmental effects.

Chapter VI

Alternatives to the Proposed Action

VI. ALTERNATIVES TO THE PROPOSED ACTION

A. NO ACTION AND DEFERRED ACTION ALTERNATIVES

The proposed project involves the development of an Advanced Technology Center (ATC) and an Advanced Technology and Research Center (ATRC), as well as related improvements. The ATC will replace the IFA's existing Waiakoa Laboratory in Kula, which lacks the office and laboratory space to sufficiently support the IFA's quickly growing high-tech research programs, while the ATRC will contain additional space for ATC uses, as well as provide research facilities which will support the University of Hawaii's general research programs.

The "no action" alternative would maintain the existing physical condition of the project site until an alternative Country Town Business use is identified for development at the property. When considering the land use context for the subject property, the "no action" alternative does not support the highest and best use of the property as reflected by the Makawao-Pukalani-Kula Community Plan (Business/Commercial) and Maui County zoning (Country Town Business) land use designations for the site. Accordingly, the "no action" alternative was not considered.

A "deferred action" alternative would have similar consequences as the "no action" alternative in that the land use objectives of the proposed project would be delayed and would not be immediately realized.

This alternative could result in potentially higher development costs due to increases in labor and material costs or as a result of changes to infrastructure or the existing physical or socio-economic environment (i.e., window of opportunity and opportunity costs). Based on the preceding, the "deferred action" alternative was not considered.

B. *SITE PLAN ALTERNATIVES*

During the project's site planning phase, the IFA's operational requirements for the proposed facilities were examined to ensure that spatial and functional criteria for the project were adequately addressed. The site planning process involved an analysis of space needs, missions and functions, area requirements, spaces and adjacencies, and people equipment activities schedule, and space relationships and layouts. Through the project's planning process, a site plan was prepared and reviewed to ensure that all operational and performance standards can be addressed.

Chapter VII

Irreversible and Irretrievable Commitments of Resources

VII. IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

The development of the proposed project is anticipated to result in the irreversible and irretrievable commitment of land and fiscal resources. Other resource commitments include energy, labor, and material resources. Impacts relating to the use of these resources should be weighed against the expected positive socio-economic benefits to be derived from the project versus the consequences of taking no action.

In addition, the proposed project is not anticipated to require a substantial commitment of government services or facilities. In general, the proposed action is not anticipated to place significant additional requirements on police, fire, medical, and social services.

Chapter VIII

Findings and Conclusions

VIII. FINDINGS AND CONCLUSIONS

The "Significance Criteria", Section 12 of the Administrative Rules, Title 11, Chapter 200, "Environmental Impact Statement Rules", were reviewed and analyzed to determine whether the proposed project will have significant impacts to the environment. The following analysis is provided:

1. ***No Irrevocable Commitment to Loss or Destruction of any Natural or Cultural Resource Would Occur as a Result of the Proposed Project***

The proposed project will not result in any adverse environmental impacts. There are no known, rare, threatened or endangered species of flora, fauna or avifauna located within the project site.

The project site was formerly used for pasture and has been recently disturbed in connection with mass grading for the Kulamalu Town Center Subdivision. The archaeological surveys of the Kulamalu project area (including the project site) did not locate any archaeological sites or cultural artifacts at the project site. Should any cultural artifacts or human remains be encountered during construction, work will immediately stop in the vicinity of the find and the find will be protected from further disturbance. The State Historic Preservation Division will be immediately notified to establish an appropriate mitigation strategy.

2. ***The Proposed Action Would Not Curtail the Range of Beneficial Uses of the Environment***

The proposed project and the commitment of land resources would not curtail the range of beneficial uses of the environment.

3. ***The Proposed Action Does Not Conflict with the State's Long-term Environmental Policies or Goals or Guidelines as Expressed in Chapter 344, Hawaii Revised Statutes***

The State's Environmental Policy and Guidelines are set forth in Chapter 344, Hawaii Revised Statutes. The proposed action is in consonance with the policies and guidelines.

4. ***The Economic or Social Welfare of the Community or State Would Not be Substantially Affected***

The proposed project would have a direct beneficial effect on the local economy during construction. In the long term, the proposed project will support the local economy through the contribution of salaries, wages, and benefits, as well as through the purchases of goods and services from local merchants and service providers.

5. ***The Proposed Action Does Not Affect Public Health***

No impacts to the public's health and welfare are anticipated as a result of the proposed project.

6. ***No Substantial Secondary Impacts, Such as Population Changes or Effects on Public Facilities are Anticipated***

No significant population changes are anticipated as a result of the proposed project.

From a land use standpoint, the proposed project is compatible with the business/commercial uses set forth for the property by the Makawao-Pukalani-Kula Community Plan and Maui County zoning.

The proposed project is not expected to adversely impact existing water and wastewater systems and facilities. Best Management Practices

(BMP's) and appropriate erosion control measures will be utilized during the construction period. Drainage system improvements will be constructed in accordance with applicable regulatory design standards to ensure that surface runoff will not have an adverse effect on adjacent or downstream properties. The project is not expected to significantly impact public services such as police, fire, and emergency medical operations. No adverse impacts to educational, recreational, and solid waste collection and disposal facilities and resources are anticipated.

7. ***No Substantial Degradation of Environmental Quality is Anticipated***

During the construction phase of the project, there will be short-term air quality and noise impacts as a result of the project. In the long term, effects upon air quality and ambient noise levels should be minimal. The project is not anticipated to significantly affect the open space and scenic character of the area.

No substantial degradation of environmental quality resulting from the project is anticipated.

8. ***The Proposed Action Does Not Involve a Commitment to Larger Actions, Nor Would Cumulative Impacts Result in Considerable Effects on the Environment***

The proposed project does not involve a commitment to larger actions.

9. ***No Rare, Threatened or Endangered Species or Their Habitats Would be Adversely Affected by the Proposed Action***

There are no rare, threatened or endangered species of flora, fauna, avifauna or their habitats on the subject property.

10. *Air Quality, Water Quality or Ambient Noise Levels Would Not be Detrimentally Affected by the Proposed Project*

Construction activities will result in short-term air quality and noise impacts. Dust control measures, such as regular watering and sprinkling, will be implemented to minimize wind-blown emissions. Noise impacts will occur primarily from construction-related activities. It is anticipated that construction will be limited to daylight working hours. Water quality is not expected to be affected.

In the long term, the project is not anticipated to have a significant impact on air and water quality or ambient noise levels.

11. *The Proposed Project Would Not Affect Environmentally Sensitive Areas, Such as Flood Plains, Tsunami Zones, Erosion-prone Areas, Geologically Hazardous Lands, Estuaries, Fresh Waters or Coastal Waters*

The project is not located within and would not affect environmentally sensitive areas. The project site is not subject to flooding or tsunami inundation. Soils of the project site are not erosion-prone. There are no geologically hazardous lands, estuaries, or coastal waters within or adjacent to the project site.

12. *The Proposed Action Would Not Substantially Affect Scenic Vistas and Viewplanes Identified in County or State Plans or Studies*

The project site is not identified as a scenic vista or viewplane. The proposed project will not affect scenic corridors and coastal scenic and open space resources.

13. *The Proposed Action Would Not Require Substantial Energy Consumption*

The proposed project will involve the short-term commitment of fuel for equipment, vehicles, and machinery during construction activities. However, this use is not anticipated to result in a substantial consumption of energy resources. In the long term, the project will create an additional demand for electricity. However, this demand is not deemed substantial or excessive within the context of the region's overall energy consumption.

Based on the foregoing findings, it is concluded that the proposed action will not result in any significant impacts.

Chapter IX

List of Permits and Approvals

IX. LIST OF PERMITS AND APPROVALS

The following permits and approvals will be required prior to the implementation of the project.

State of Hawaii

1. Community Noise Permit (as applicable)
2. NPDES Permit

County of Maui

1. Construction Permits (e.g., grading, building, driveway, electrical, plumbing)

Chapter X

Agencies Consulted During the Preparation of the Draft Environmental Assessment; Letters Received and Responses to Substantive Comments

X. AGENCIES CONSULTED DURING THE PREPARATION OF THE DRAFT ENVIRONMENTAL ASSESSMENT; LETTERS RECEIVED AND RESPONSES TO SUBSTANTIVE COMMENTS

The following agencies were consulted during the preparation of the Draft Environmental Assessment. Agency comments and responses to substantive comments are also included in this section.

1. Neal Fujiwara, Soil Conservationist
   Natural Resources Conservation Service
   U.S. Department of Agriculture
   210 Imi Kala Street, Suite 209
   Wailuku, Hawaii 96793-2100

2. George Young, P.E.
   Chief, Regulatory Branch
   U.S. Department of the Army
   U.S. Army Engineer District, Hnl.
   Attn: CEPOH-EC-R
   Bldg. 230, Room 201
   Fort Shafter, Hawaii 96858-5440

3. Robert P. Smith
   Pacific Islands Manager
   U. S. Fish and Wildlife Service
   300 Ala Moana Blvd., Rm. 3-122, Box 50088
   Honolulu, Hawaii 96813

4. Sandra Lee Kunimoto, Chairman
   State Of Hawaii
   Department of Agriculture
   1428 South King Street
   Honolulu, Hawaii 96814-2512

5. Micah Kane, Chairman
   State of Hawaii
   Department of Hawaiian Home Lands
   P.O. Box 1879
   Honolulu, Hawaii 96805

6. Chiyome L. Fukino M.D., Director
   State of Hawaii
   Department of Health
   P.O. Box 3378
   Honolulu, Hawaii 96801

7. Herbert Matsubayashi
   District Environmental Health Program Chief
   State of Hawaii
   Department of Health
   54 High Street
   Wailuku, Hawaii 96793

8. Peter T. Young, Director
   State of Hawaii
   Department of Land and Natural Resources
   P. O. Box 621
   Honolulu, Hawaii 96809

9. P. Holly Mc Eldowney, Acting Administrator
   State of Hawaii
   Department of Land and Natural Resources
   State Historic Preservation Division
   601 Kamokila Blvd., Room 555
   Kapolei, Hawaii 96707

10. Fred Cajigal, Maui District Engineer
    State of Hawaii
    Department of Transportation
    Highways Division
    650 Palapala Drive
    Kahului, Hawaii 96732

11. Clyde Namu'o, Administrator
    Office of Hawaiian Affairs
    711 Kapiolani Boulevard, Suite 500
    Honolulu, Hawaii 96813

12. Richard Fernandez, Chief
    County of Maui
    Department of Fire Control
    200 Dairy Road
    Kahului, Hawaii 96732

13. Alice Lee, Director
County of Maui
Department of Housing and Human Concerns
200 S. High Street
Wailuku, Hawaii 96793

14. Michael W. Foley, Director
County of Maui
Department of Planning
250 South High Street
Wailuku, Hawaii 96793

15. Glenn Correa, Director
County of Maui
Department of Parks and Recreation
1580-C Kaahumanu Avenue
Wailuku, Hawaii 96793

16. Tom Phillips, Chief
County of Maui
Police Department
55 Mahalani Street
Wailuku, Hawaii 96793

17. Gilbert Coloma-Agaran, Director
County of Maui
Department of Public Works and Waste Management
200 South High Street
Wailuku, Hawaii 96793

18. George Tengan, Director
County of Maui
Department of Water Supply
200 South High Street
Wailuku, Hawaii 96793

19. Lynn Araki-Reagan, Coordinator
County of Maui
Office of Economic Development
200 South High Street
Wailuku, Hawaii 96793

20. Honorable Charmaine Tavares
Councilmember
Maui County Council
200 South High Street
Wailuku, Hawaii 96793

21. Ms. Elliott Krash
Kula Community Association
P.O. Box 417
Kula, Hawaii 96790

22. Lynn Woods, Executive Director
Maui Chamber of Commerce
250 Alamaha Street, Suite N16A
Kahului, Hawaii 96732

AUG 0 5 2002
JAMES "KIMO" APANA
Mayor

FLOYD S. MIYAZONO
Director

GLENN T. CORREA
Deputy Director

(808) 270-7230
Fax (808) 270-7934

DEPARTMENT OF PARKS & RECREATION

1580-C Kaahumanu Avenue, Wailuku, Hawaii 96793

July 31, 2002

Glenn Tadaki, Planner
Munekiyo & Hiraga, Inc.
305 High Street, Suite 104
Wailuku, Hawaii 96793

Dear Mr. Tadaki:

SUBJECT: PROPOSED ADVANCED TECHNOLOGY CENTER AND ADVANCED TECHNOLOGY RESEARCH CENTER
TMK 2-3-08:38 and 39 (por.)

Thank you for the opportunity to review the summary of the subject project. At this time, we have no comments or objections to the proposed action.

Please contact me or Mr. Patrick Matsui, Chief of Parks Planning and Development, at 270-7387 if there are any questions.

Sincerely,

Floyd S. Miyazono

FLOYD S. MIYAZONO
Director

c: Patrick Matsui, Chief of Planning and Development

DEPARTMENT OF
HOUSING AND HUMAN CONCERNS
COUNTY OF MAUI

JAMES "KIMO" APANA
Mayor
ALICE L. LEE
Director
PRISCILLA P. MIKELL
Deputy Director

200 SOUTH HIGH STREET • WAILUKU, HAWAII 96793 • PHONE (808) 270-7805 • FAX (808) 270-7165

August 2, 2002

Mr. Glenn Tadaki, Planner
Munekiyo & Hiraga, Inc.
305 High Street, Suite 104
Wailuku, Hawaii 96793

Dear Mr. Tadaki:

SUBJECT: PROPOSED ADVANCED TECHNOLOGY CENTER AND ADVANCED TECHNOLOGY RESEARCH CENTER, TMK: 2-3-08:38 and 39(POR.)

We have reviewed the project summary that was attached to your July 26, 2002 letter and wish to inform you that we have no comment to offer.

Thank you for the opportunity to comment.

Very truly yours,

Alice L. Lee

ALICE L. LEE
Director

ETO:hs

c: Housing Administrator

AUG -9 2002

DEPARTMENT OF THE ARMY
U. S. ARMY ENGINEER DISTRICT, HONOLULU
FT. SHAFTER, HAWAII 96858-5440

REPLY TO
ATTENTION OF

August 7, 2002

Regulatory Branch

Mr. Glenn Tadaki, Planner
Munekiyo & Hiraga, Inc.
305 High Street, Suite 104
Wailuku, Hawaii 96793

Dear Mr. Tadaki:

This responds to your written request for review comments on the Environmental Assessment preparation notice for University of Hawaii Institute for Astronomy development of an Advanced Technology Center and Advanced Technology Research Center on a 3.4-acre site within the Kulamalu Commercial Subdivision in Kula, Maui (TMK 2-3-08: 38 and por. 39). We have reviewed the document with respect to the Corps' authority to issue Department of the Army (DA) permits under Section 10 of the River and Harbor Act of 1899 (33 USC 403) and Section 404 of the Clean Water Act (33 USC 1344).

The project summary you provided does not contain sufficient information to enable determination of DA permit requirements. Any activity which would involve the discharge of dredged or fill material below the ordinary high water mark of Kaluapulani Gulch or its unnamed tributaries, or into adjacent wetlands, may require a DA permit. We can provide a determination of DA permit requirements for the project when it is further delineated with respect to these or other water bodies which may be present.

File number 200200457 has been assigned to this project. Should you have questions regarding these comments, please contact Mr. Peter Galloway of my staff at 438-8416 (fax 438-4060). Mailed inquiries should be addressed to: Regulatory Branch (CEPOH-EC-R/P. Galloway); U.S. Army Engineer District, Honolulu; Building 230; Fort Shafter, Hawaii 96858-5440. Thank you for working with the U.S. Army Corps of Engineers in protecting the aquatic resources of Hawaii.

Sincerely,

William B. Lennan
for George P. Young, P.E.
Chief, Regulatory Branch

JAMES "KIMO" APANA
MAYOR

POLICE DEPARTMENT
COUNTY OF MAUI

55 MAHALANI STREET
WAILUKU, HAWAII 96793
(808) 244-6400
FAX (808) 244-6411

THOMAS M. PHILLIPS
CHIEF OF POLICE

KEKUHAUPIO R. AKANA
DEPUTY CHIEF OF POLICE

OUR REFERENCE ty
YOUR REFERENCE

August 9, 2002

Mr. Glenn Tadaki
Planner
Munekiyo & Hiraga, Inc.
305 High Street, Suite 104
Wailuku, HI 96793

Dear Mr. Tadaki:

SUBJECT: Proposed Advanced Technology Center and Advanced Technology Research Center TMK 2-3-08:38 and 39 (por.)

Thank you for your letter of July 26, 2002, requesting comments on the above subject.

The assessment was reviewed and we have no additional comments or recommendations at this time. Thank you for giving us the opportunity to comment on this project. We are returning the summary which was submitted for our review.

Very truly yours,

AC

Assistant Chief Robert Tam Ho
for: Thomas M. Phillips
Chief of Police

Enclosure

c: John E. Min, Planning Department

JAMES "KIMO" APANA
Mayor

DAVID C. GOODE
Director

MILTON M. ARAKAWA, A.I.C.P.
Deputy Director

Telephone: (808) 270-7845
Fax: (808) 270-7955

COUNTY OF MAUI
DEPARTMENT OF PUBLIC WORKS AND WASTE MANAGEMENT
200 SOUTH HIGH STREET
WAILUKU, MAUI, HAWAII 96793

RALPH NAGAMINE, L.S., P.E.
Land Use and Codes Administration

TRACY TAKAMINE, P.E.
Wastewater Reclamation Division

LLOYD P.C.W. LEE, P.E.
Engineering Division

BRIAN HASHIRO, P.E.
Highways Division

JOHN D. HARDER
Solid Waste Division

August 14, 2002

Mr. Glenn Tadaki
MUNEKIYO & HIRAGA, INC.
305 High Street, Suite 104
Wailuku, Hawaii 96793

Dear Mr. Tadaki

SUBJECT: EARLY CONSULTATION FOR ENVIRONMENTAL ASSESSMENT
UNIVERSITY OF HAWAII - INSTITUTE FOR ASTRONOMY
TECHNOLOGY CENTER
TMK: (2)2-3-008:038, 039

We have reviewed the early consultation transmitted for the subject Environmental Assessment and have the following comments:

1. Submit a plan for construction waste disposal and recycling and cleared and grubbed disposal and composting.

2. The project shall comply with the provisions of Title 18, Maui County Code (MCC), Subdivisions; Chapter 20.08, MCC, Grading Ordinance and Maui County Drainage Rules.

If you have any questions regarding this letter, please call Milton Arakawa at 270-7845.

Sincerely,

Milton Arakawa
for DAVID GOODE
Director

DG:RGM:msc
S:\LUCA\CZM\UH-astronomytechctr.wpd

Quality Seamless Service – Now and for the Future

MUNEKIYO & HIRAGA, INC.

April 10, 2003

Gilbert Coloma-Agaran, Director
Department of Public Works
and Environmental Management
County of Maui
200 South High Street
Wailuku, Hawaii 96793

SUBJECT: Proposed Advanced Technology Center and Advanced Technology and Research Center; TMK 2-3-08: 38 and 39 (por)

Dear Mr. Coloma-Agaran:

On behalf of the applicant, the University of Hawaii, Institute for Astronomy, we would like to note the following in response to your department's August 26, 2002 early consultation comments on the proposed project.

Construction waste disposal and recycling will be the responsibility of the contractor. Provisions for the disposal of construction waste and recycling will be noted in the project's construction plans. In addition, the project will be developed in accordance with the applicable provisions of the Maui County Code and Maui County Drainage Rules ertaining to subdivisions, grading, and drainage.

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

Very truly yours,

Glenn Tadaki, Planner

GT:yp
cc: Michael Maberry, University of Hawaii, Institute for Astronomy
Don Fujimoto, Kulamalu Science, LLC
dowling\astronmy\dpwem.res

305 High Street, Suite 104 · Wailuku, Hawaii 96793 · ph: (808)244-2015 · fax: (808)244-8729 · planning@mhinconline.com

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AUG 2? 2002

PHONE (808) 594-1888

FAX (808) 594-1865

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

HRD 02-690

Date: August 15, 2002

To: Glenn Tadaki, Planner
Munekiyo & Hiraga, Inc.
305 South High Street
Suite 104
Wailuku, HI 96793

Subject: Proposed Advanced Technology Center and Advanced Technology Research Center
Kulamalu Commercial Subdivision

District, Island: Kula, Maui
TMK: 2-3-08:38 and 39 (por)

Thank you for the opportunity to review the Project Summary for the Proposed Advanced Technology Center and Advanced Technology Research Center.

The Office of Hawaiian Affairs offers no comment on the single-paged project summary. However, OHA anticipates receiving your Environmental Assessment (EA) for the project and reserves comment subsequent to our review of your archaeological survey and cultural resource inventory

You may direct any questions or comments to Aulani Apoliona at 594-1962.

Sincerely,

Jalna Keala

Jalna Keala
Acting Hawaiian Rights Director

C: ADM
BOT

KULA COMMUNITY ASSOCIATION
P.O. Box 41 - Kula, HI 96790
http://kulamaui.com

The vision of the Kula Community Association is to preserve open space, support agriculture, maintain a rural residential atmosphere, and to work together as a community.
The specific purpose of this association is to improve the quality of life for the residents of Kula, to promote civic welfare and generally to benefit the community of Kula.

August 16, 2002

Mr. Glenn Tadaki, Planner
Munekiyo & Hiraga, Inc.
305 High Street, Suite 104
Wailuku, HI 96793

Subject: University of Hawaii, Institute for Astronomy (IFA) Advanced Technology Center (ATC) and Advanced Technology Research Center (ATRC), Kulamalu Commercial Subdivision, Kula, Maui

Dear Mr. Tadaki:

Thank you for inviting the comments of the Kula Community Association (KCA) on the proposed IFA Centers at the Kulamalu Commercial Subdivision in Kula, Maui. We are aware of the limitations of the current site in Waiakoa and the need for a new state-of-the-art facility. We also understand that the project is planned to be completed in two phases, with construction of the ATC scheduled to begin in 2003 and completion estimated for mid 2004.

The KCA Board of Directors supports the current proposals for the Kulamalu project as presented by Mr. Dowling at a recent KCA Board Meeting. His vision of Kulamalu is a small, country town with mixed uses including single and multifamily residential, parks and open space, research, technology, education, services, and family-oriented businesses and activities. This is also congruent with the Kulamalu "Country-Town Business" project as outlined in the Pukalani-Makawao-Kula Community Plan.

The proposed IFA project is conceptually consistent with the Kulamalu plan. For the vision to become reality, however, many details must be resolved. Listed below are a few of the issues we would expect to be satisfactorily addressed in the Environmental Assessment (EA) and other phases of the project.

- The EA should analyze traffic related issues such as employee and visitor car trips, truck and other vehicle traffic, hours of operation, and noise generation. The impact of such activities on the Kula Highway and other nearby roads and should be studied for the eventual build-out and use of the facility.
- The proposed project will consist of two large buildings and parking for almost 200 cars on a lot of less than three and a half acres. Therefore, it is essential that the buildings and parking areas be planned, arranged, and constructed on the site in such a way as to not have an adverse impact on the aesthetics and scenic vistas of the general area. The building shapes, exterior materials, landscaping, and color schemes should be chosen to reflect the country town atmosphere.
- The concerns and comments of all residents and businesses in the area should be addressed in the EA. The public hearings and meetings to hear residents' concerns should be held in Pukalani or Kula and preferably in the evenings to make it convenient for Upcountry residents to attend.

We hope our comments are helpful in preparing the EA. Should you want to discuss them further or arrange a meeting, please call either our KCA Planning Committee chair Hari Ajmani (878-3702) or me (878-1342). We look forward to continuing participation in the process as the project progresses.

Yours truly,

Elliott Krash

Elliott Krash, President

Cc: Alan AhSam, University of Hawaii
Don Fujimoto, Kulamalu Science LLC

MUNEKIYO & HIRAGA, INC.

April 10, 2003

Elliott Krash, President
Kula Community Association
P.O. Box 41
Kula, Hawaii 96790

SUBJECT: Proposed Advanced Technology Center and Advanced Technology Research Center; TMK 2-3-08: 38 and 39 (por.)

Dear Mr. Krash:

Thank you for providing us with your August 18, 2002 early consultation comments on the proposed project. On behalf of the applicant, the University of Hawaii, Institute for Astronomy, we would like to note the following.

The Draft Environmental Assessment (EA) will include information on project-related traffic, as well as assess traffic-related impacts. The layout of the project's onsite facilities will be designed to complement the surrounding area; buildings will be designed in accordance with Country Town Design Guidelines. A community information meeting is planned during the Draft EA public comment period.

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

Very truly yours,

Glenn Tadaki, Planner

GT:yp
cc: Michael Maberry, University of Hawaii, Institute for Astronomy
Don Fujimoto, Kulamalu Science, LLC
dowling\astronomy\kca.res

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AUG 21 2002

BENJAMIN J. CAYETANO
GOVERNOR

BRUCE S. ANDERSON, Ph.D., M.P.H.
DIRECTOR OF HEALTH

LORRIN W. PANG, M.D., M.P.H
MAUI DISTRICT HEALTH OFFICER

STATE OF HAWAII
DEPARTMENT OF HEALTH
MAUI DISTRICT HEALTH OFFICE
54 HIGH STREET
WAILUKU, MAUI, HAWAII 96793

August 19, 2002

Mr. Glenn Tadaki
Planner
Munekiyo & Hiraga, Inc.
305 South High Street, Suite 104
Wailuku, Hawai`i 96793

Dear Mr. Tadaki:

Subject: **Proposed Advanced Technology Center and Advanced Technology Research Center**
TMK: (2) 2-3-08:38 and 39 (por.)

Thank you for the opportunity to participate in the environmental early consultation process for the proposed technology and research center. Comments from this office were transmitted to our Honolulu Office. A coordinated response is forthcoming.

Should you have any questions, please call me at 984-8230.

Sincerely,

Herbert S. Matsubayashi
District Environmental Health Program Chief

c: Lance Tauoa

GOVERNOR

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION
MAUI DISTRICT
650 PALAPALA DRIVE
KAHULUI, HAWAII 96732

BRIAN K. MINAAI
DIRECTOR

DEPUTY DIRECTORS
JEAN L. OSHITA
JADINE Y. URASAKI

IN REPLY REFER TO:

HWY-M2.271-02

August 19, 2002

MEMORANDUM

TO: **Glenn Tadaki**
Munekiyo & Arakawa, Inc.

FROM: **Paul M. Chung**
State Highways

SUBJECT: **Advanced Technology Research Center**
ME 02-42

Thank you for the opportunity to review and comment on the proposed Astronomy Research Center within the Kulamalu Commercial Subdivision. Based upon our review of the proposal, please include a Traffic Impact Analysis Report when preparing the Environmental Assessment.

If there are any questions or concerns, please call me at 873-3535.

/pmc

MUNEKIYO & HIRAGA, INC.

April 10, 2003

Paul Chung
Highways Division, Maui District
Department of Transportation
State of Hawaii
650 Palapala Drive
Kahului, Hawaii 96732

SUBJECT: Proposed Advanced Technology Center and Advanced Technology Research Center; TMK 2-3-08: 38 and 39 (por.)

Dear Mr. Chung:

Thank you for providing us with your August 19, 2002 early consultation comments on the proposed project. On behalf of the applicant, the University of Hawaii, Institute for Astronomy, we would like to note that a traffic study will be included in the project's Draft Environmental Assessment (EA).

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

Very truly yours,

Glenn Tadaki, Planner

GT:yp
cc: Michael Maberry, University of Hawaii, Institute for Astronomy
Don Fujimoto, Kulamalu Science, LLC
dowling\astronomy\dot.res

AUG 29 2002

DEPARTMENT OF WATER SUPPLY
COUNTY OF MAUI
P.O. BOX 1109
WAILUKU, MAUI, HAWAII 96793-6109
Telephone (808) 243-7816 • Fax (808) 243-7833

August 26, 2002

Glenn Tadaki, Planner
Munekiyo & Hiraga, Inc.
305 High, Suite 104
Wailuku, Hawaii 96793
Ph: (808) 244-2015
Fax (808) 244-8729

Re: Project: Proposed Advanced Technology Center and Advanced Technology Research Center – Early Consultation for Environmental Assessment
TMK: 2-3-08:038, 039

Dear Mr. Glenn Tadaki:

Thank you for the opportunity to review this proposal. The following comments are made in reference to the proposed Advanced Technology Center and Advanced Technology Research Center on 3.4 acre parcel within the Kulamalu Commercial Subdivision in Kula, Maui: TMK: 2-3-08:038,039. The Kulamalu Subdivision water system improvements have not been completed and turned over to Department of Water Supply. Therefore, water service is not currently available.

The project is located on the Makawao Aquifer. The 12-inch waterline that will ultimately serve the site has not yet been completed and accepted by DWS. DWS standard commercial property consumption is 20,400gpd for 3.4 acres or 7,700gpd for 55,000 sq. ft. The Final Environmental Assessment should identify source, transmission and anticipated consumption for current and cumulative phases of the project.

Should the applicant be utilizing Kulamalu Inc. storage, transmission, or source credits the Board of Water Supply will need to be notified. Kulamalu Inc. will need to submit a letter (schedule "G" of the "Agreement Concerning the Construction of Storage Tank, Transmission Line and Appurtenances, and Development of Well" dated March 21, 1996) notifying Board of Water Supply of their intent to exercise a portion of the storage, transmission, and source credits allocated under the agreement. If credits have been exhausted, the applicant shall be required to pay the water system development fees and be placed on the Upcountry meter priority list in order to receive water service. The applicant is encouraged to contact our engineering division at 270-7835 to discuss the matter further.

The applicant will be required to comply with Water Department Rules and Regulations as well as provide for adequate fire protection, domestic source and backflow prevention in accordance to system standards. We recommend the applicant coordinate with our engineering division regarding system improvements. To determine actual domestic, commercial and irrigation demand, calculations need to be made and stamped by a certified engineer. The approved fire flow calculation methods for the applicant's use include "Fire Flow -Hawaii Insurance Bureau, 1991 and Guide for Determination of Required Fire Flow" - Insurance Services Office, 1974.

The project is located within a Wellhead Protection Area (WHPA), as delineated by preliminary modeling efforts for a wellhead protection program. This indicates that water from the project site could affect drinking water supply wells within a 10-year time of travel for Haiku and Paia. DWS encourages the applicant to utilize Best Management Practices (BMP's) designed to minimize infiltration and runoff from all construction and vehicle operations.

State Department of Health Source Water Assessment Program Plan (SWAP) gives Research Labs a "High Contamination Potential" rating. A Few of the Chemicals listed for research labs in this review include: Barium, Benzene, Beryllium, Dichloromethane or Methylene Chloride, Endrin, Lead, Mercury, Selenium, Sulfuric Acid. We have provided Best Management Practices for managing chemicals that the research laboratory may use to carry out its function. The Final Environmental Assessment should outline which hazardous and toxic chemicals that will be used and how these substances will be handled while in use and disposed of after use. Additional information on BMP's for this type of activity is available through the State Department of Health.

The project is located in the Maui County Planting Plan - Plant Zone 2 and 4. In the event of future landscape renovations, we encourage the applicant to utilize appropriate native and non-invasive species and avoid the use of potentially invasive plants. Native plants adapted to the area, conserve water and further protect the watershed from degradation due to invasive alien species. Attached is a list of appropriate plants for the zones as well as potentially invasive plants to avoid.

We ask the applicant to consider conservation measures in and around the property. Some of these measures are listed for your use.

Utilize Low-Flow Fixtures and Devices: Maui County Code Subsection16.20A.680 requires the use of low-flow water fixtures and devices in faucets, Showerheads, Urinals, water closets and hose bibs. Water conserving washing machines, icemakers, and other units are also available.

Maintain Fixtures to Prevent Leaks: A simple, regular program of repair and maintenance can prevent the loss of hundreds or even thousands of gallons a day. Refer to the attached handout; "The Costly Drip" The applicant should establish a regular maintenance program.

Please feel free to contact our Water Resources and Planning Division at 270-7199, should you have any other questions.

Sincerely,

David Craddick

Director

mni

CC: Planning Department
Engineering Division
Applicant, w/ attachments

1) "The Costly Drip"
2) Ordinance 2108 B "An ordinance amending Chapter 16.20 of the Maui County Code, pertaining to the Plumbing Code"
3) Zone - Specific Native and Polynesian Plants: Zone 2 and 4
4) Best Management Practices – EPA's Guidance Specifying Management Measures for Sources of Non-point Pollution in Coastal Waters - Construction Activities
5) BMP's for Managing Small Quantity Chemical Use to Prevent Contamination of Drinking Water.
6) "A Checklist for Water Conservation Ideas for Commercial Buildings"

MUNEKIYO & HIRAGA, INC.

April 10, 2003

George Tengan, Director
Department of Water Supply
County of Maui
200 High Street
Wailuku, Hawaii 96793

SUBJECT: Proposed Advanced Technology Center and Advanced Technology Research Center; TMK 2-3-08: 38 and 39 (por.)

Dear Mr. Tengan:

On behalf of the applicant, the University of Hawaii, Institute for Astronomy, we would like to note the following in response to your department's August 26, 2002 early consultation comments on the proposed project.

Information on water source, transmission, and projected use will be included in the project's Draft Environmental Assessment (EA). The applicant will also inform the Board of Water Supply should Kulamalu Inc. storage, transmission, or source credits be utilized for the project.

Water system improvements will be coordinated with the department's Engineering Division and Best Management Practices (BMPs) will be implemented during construction to minimize infiltration and runoff from construction-related activities. Should hazardous or toxic chemicals, such as those identifed in your letter be utilized in the facility's research labs, those substances will be identified in the Draft EA and appropriate BMPs for the management of these chemicals will be utilized. The water conservation measures reflected in your letter will be considered for the project.

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

Very truly yours,

Glenn Tadaki, Planner

GT:yp

cc: Michael Maberry, University of Hawaii, Institute for Astronomy
Don Fujimoto, Kulamalu Science, LLC

dowling\astmomy\dws.res

SEP 03 2002

BENJAMIN J. CAYETANO
GOVERNOR OF HAWAII

STATE OF HAWAII
DEPARTMENT OF HEALTH
P.O. BOX 3378
HONOLULU, HAWAII 96801

BRUCE S. ANDERSON, Ph.D., M.P.H.
DIRECTOR OF HEALTH

In reply, please refer to:
File:

02-197/cpo

August 27, 2002

Mr. Glenn Tadaki, Planner
Munekiyo & Hiraga, Inc.
305 High Street, Suite 104
Wailuku, Hawaii 96793

Dear Mr. Tadaki:

Subject: Pre-Environmental Assessment (PEA) Consultation
University of Hawaii Advanced Technology Research Center
Kula, Maui, Hawaii State Dept. of Health
Tax Map Key: 2-3-008:038 and 039 (por.)

Thank you for the opportunity to review and comment on the subject proposal. The PEA request was routed to the various branches of the Environmental Health Administration. We have the following comments.

Clean Water Branch (CWB)

1. The applicant should contact the Army Corps of Engineers to identify whether a federal permit (including a Department of Army permit) is required for this project. A Section 401 Water Quality Certification is required for "Any applicant for Federal license or permit to conduct any activity including, but not limited to, the construction or operation of facilities, which may result in any discharge into the navigable waters...", pursuant to Section 401(a)(1) of the Federal Water Pollution Act (commonly known as the "Clean Water Act");

2. A National Pollutant Discharge Elimination System (NPDES) general permit coverage is required for the following discharges to waters of the State:

    a. Discharge of storm water runoff associated with industrial activities, as define in Title 40, Code of Federal Regulations, Sections 122.26(b)(14)(i) through 122.26(b)(14)(ix) and 122.26(b)(14)(xi);

b. Discharge of storm water runoff associated with construction activities that involve the disturbance of five (5) acres or greater, including clearing, grading, and excavation;

c. Discharge of treated effluent from leaking underground storage tank remedial activities;

d. Discharge of once through cooling water less than one million gallons per day;

e. Discharge of hydro-testing water;

f. Discharge of construction dewatering effluent;

g. Discharge of treated effluent from petroleum bulk stations and terminals; and

h. Discharge of treated effluent from well drilling activities.

Any person requesting to be covered by a NPDES general permit for any of the above activities should file a Notice of Intent with the Department of Health, Clean Water Branch (CWB) at least thirty (30) days prior to commencement of any discharges to State waters;

3. If construction activities involve the disturbance of one acre or greater, including clearing, grading, and excavation, and will take place or extend after March 10, 2003, an NPDES general permit coverage is required for discharges of storm water runoff into State waters; and

4. The applicant may be required to apply for an individual NPDES permit if there is any type of activity in which wastewater is discharged from the project into State waters.

If you have any questions, please contact the Clean Water Branch at (808) 586-4309.

Wastewater Branch (WWB)

Wastewater generation, treatment and disposal have not been addressed in the submitted document. Previous correspondence indicated that the project was considering connecting to the private wastewater facility in the Pukalani Terrace development. Use of on-site individual wastewater systems is not acceptable for this development. A treatment works would be required.

All wastewater plans must conform to applicable provisions of the Department of Health's Administrative Rules, Chapter 11-62, "Wastewater Systems". We reserve the right to review the detailed wastewater plans for conformance to applicable rules.

If you have any questions, please contact the Planning/Design Section of the Wastewater Branch at (808) 586-4294.

<u>Clean Air Branch (CAB)</u>

Control of Fugitive Dust

There is a significant potential for fugitive dust emissions during the removal, transport and installation activities for this project. Project activities will be, at times, conducted within the vicinity of neighboring residential dwellings, major thoroughfares and a school. It is recommended that a dust control management plan be developed which identifies and addresses all activities that have a potential to generate fugitive dust. Implementation of adequate dust control measures during all phases of development and construction activities is warranted.

Construction activities must comply with provisions of Hawaii Administrative Rules, Chapter 11-60.1, "Air Pollution Control," Section 11-60.1-33, Fugitive Dust.

The contractor should provide adequate measures to control dust from the road areas and during the various phases of construction. These measures include, but are not limited to:

a. Planning the different phases of construction, focusing on minimizing the amount of dust generating materials and activities, centralizing on-site vehicular traffic routes, and locating potentially dusty equipment in areas of the least impact;

b. Providing an adequate water source at the site prior to start up of construction activities;

c. Landscaping and rapid covering of bare areas, including slopes, starting from the initial grading phase;

d. Controlling of dust from shoulders and access roads;

e. Providing adequate dust control measures during weekends, after hours, and prior to daily start-up of construction activities; and

f. Controlling of dust from debris being hauled away from project site.

If you have any questions regarding these issues on fugitive dust, please contact the Clean Air Branch at (808) 586-4200.

Noise, Radiation and Indoor Air Quality (NRIAQ) Branch

All project activities shall comply with the Administrative Rules of the Department of Health, Chapter 11-46, on "Community Noise Control".

If you have any questions, please contact the NRIAQ at (808) 586-4701.

Sincerely,

GARY GILL
Deputy Director
Environmental Health Administration

c: CWB
WWB
CAB
NRIAQ
Maui DHO

MUNEKIYO & HIRAGA, INC.

April 10, 2003

Chiyome L. Fukino, M.D., Director
for Environmental Health
Department of Health
State of Hawaii
P.O. Box 3378
Honolulu, Hawaii 96801

SUBJECT: Proposed Advanced Technology Center and Advanced Technology Research Center; TMK 2-3-08: 38 and 39 (por.)

Dear Ms. Fukino:

On behalf of the applicant, the University of Hawaii, Institute for Astronomy, we would like to note the following in response to your department's August 26, 2002 early consultation comments on the proposed project.

The U.S. Army Corps of Engineers has also been consulted in connection with the project's early consultation process. In addition, construction activities will comply with applicable Department of Health requirements regarding NPDES general permit coverage, air pollution control, and community noise control. Wastewater disposal and treatment will be accommodated by the privately-operated Pukalani Terrace wastewater treatment facility.

Thank you again for providing us with your comments. Please feel free to call me should you have any questions.

Very truly yours,

Glenn Tadaki, Planner

GT:yp
cc: Michael Maberry, University of Hawaii, Institute for Astronomy
Don Fujimoto, Kulamalu Science, LLC
dowling\astmomy\doh.res

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BENJAMIN J. CAYETANO
GOVERNOR OF HAWAII

STATE OF HAWAII

SEP 04 2002

GILBERT S. COLOMA-AGARAN, CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCES MANAGEMENT

DEPUTIES
ERIC T. HIRANO
LINNEL NISHIOKA

DEPARTMENT OF LAND AND NATURAL RESOURCES

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

AQUATIC RESOURCES
BOATING AND OCEAN RECREATION
COMMISSION ON WATER RESOURCE MANAGEMENT
CONSERVATION AND RESOURCES ENFORCEMENT
CONVEYANCES
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION
LAND
STATE PARKS

August 27, 2002

Mr. Glen Tadaki
Munekiyo & Hiraga, Inc.
305 South High Street, Suite 104
Wailuku, Hawaii 96793

LOG NO: 30606 ✓
DOC NO: 0208CD50

Dear Mr. Tadaki,

SUBJECT: **Chapter 6E-8 Historic Preservation Review Pertaining to an Information Request for the Proposed Advanced Technology Center and Advanced Technology Research Center**
'A'apueo Ahupua'a, Makawao District, Island of Maui
TMK: (2) 2-3-008:038 and 039 por.

Thank you for the opportunity to review and comment on the information request pertaining to the proposed Advanced Technology Center and Advanced Technology Research Center, which was received by our staff July 26, 2002.

Based on the submitted information request, we understand the proposed undertaking consists of the proposed development of an Advanced Technology Center and Advanced Technology Research Center on a 3.4-acre site within the Kulamalu Commercial Subdivision in Kula.

Our records indicate that an acceptable archaeological inventory survey has been conducted of the subject properties during which three petroglyph sites had been identified and requested a preservation plan for these sites to be submitted to this office for review (SHPD DOC NO: 9912CD18/LOG NO.: 24653, SHPD DOC NO.: 9712BD36). We have previously reviewed and accepted the preservation plan pertaining to sites 50-50-10-4179 and 50-50-10-1061 (SHPD DOC NO.: 9909RC06/LOG NO.: 24075). We recently reviewed and accepted the preservation plan for site 50-50-10-1062 (SHPD DOC NO.: 0101MK08/LOG NO.: 26839). As preservation plans have been accepted and are in place, we believe the proposed undertaking will have "no adverse effect" on significant historic sites provided the conditions stipulated in these preservation plans are followed.

Please call Cathleen Dagher at 692-8023 if you have any questions.

Aloha,

Don Hibbard, Administrator
State Historic Preservation Division

CD:jen

OCT 17 2002

JAMES "KIMO" APANA
Mayor

JOHN E. MIN
Director

CLAYTON I. YOSHIDA
Deputy Director

COUNTY OF MAUI
DEPARTMENT OF PLANNING

October 14, 2002

Mr. Glenn Tadaki
Munekiyo & Hiraga Inc.
305 High Street, Suite 104
Wailuku, Maui, Hawaii 96793

Dear Mr. Tadaki:

RE: Early Consultation for Draft Environmental Assessment (EA) for the Proposed Advanced Technology Center and Advanced Technology Research Center at Kulamalu, TMK 2-3-008: 38 and 39 (por.)

The Planning Department (Department) has reviewed the summary for the proposed project. In December, 2000, design guidelines were approved for Kulamalu Village. The design of the project should be in keeping with the approved design guidelines.

The Department will most likely have additional comments as part of our review of the complete draft EA document.

Thank you for your cooperation in this matter. If further clarification is required, please contact Ms. Ann T. Cua, Staff Planner, of this office at 270-7735.

Very truly yours,

JOHN E. MIN
Planning Director

JEM:ATC:tlm
c: Clayton Yoshida, AICP, Deputy Planning Director
Kulamalu TMK file
Ann T. Cua, Staff Planner
Project File
General File
K:\WP_DOCS\PLANNING\LETTERS\ltr2002\4077KulamalutechcentrEAearlyconsult

MUNEKIYO & HIRAGA, INC.

April 10, 2003

Michael W. Foley, Director
Department of Planning
County of Maui
250 South High Street
Wailuku, Hawaii 96793

SUBJECT: Proposed Advanced Technology Center and Advanced Technology Research Center; TMK 2-3-08: 38 and 39 (por.)

Dear Mr. Foley:

On behalf of the applicant, the University of Hawaii, Institute for Astronomy, and in response to your department's October 14, 2002 early consultation comments on the proposed project, we would like to note that the project will be developed in accordance with the design standards for Kulamalu Village.

Thank you again for providing us with your comments. Please feel free to call me should you have any questions.

Very truly yours,

Glenn Tadaki, Planner

GT:yp
cc: Mike Maberry, University of Hawaii, Institute for Astronomy
Don Fujimoto, Kulamalu Science, LLC
dowling\astronmy\pd.res

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Chapter XI

Letters Received During the Draft Environmental Assessment Public Comment Period and Responses to Substantive Comments

XI. LETTERS RECEIVED DURING THE DRAFT ENVIRONMENTAL ASSESSMENT PUBLIC COMMENT PERIOD AND RESPONSES TO SUBSTANTIVE COMMENTS

The Draft Environmental Assessment (EA) for the proposed project was published in the March 23, 2004 edition of the Environmental Notice. Copies of the Draft EA were provided to agencies, organizations, and individuals for review and comment. The 30-day public comment period for the Draft EA expired on April 22, 2004. Letters received during the Draft EA public comment period, as well as responses to substantive comments, are included in this section. In addition, a meeting with the Kula Community Association's Board of Directors was held on May 11, 2004. A summary of this meeting is included at the end of this section as well.

MAR 26 2004

DEPARTMENT OF
HOUSING AND HUMAN CONCERNS
HOUSING DIVISION
COUNTY OF MAUI

ALAN M. ARAKAWA
Mayor
ALICE L. LEE
Director
HERMAN T. ANDAYA
Deputy Director

86 W. KAMEHAMEHA AVENUE • KAHULUI, HAWAII 96732-2259 • PHONE (808) 270-7351 • FAX (808) 270-6284

March 23, 2004

Mr. Michael Munekiyo, A.I.C.P.
Project Manager
Munekiyo & Hiraga, Inc.
305 High Street, Suite 104
Wailuku, Hawaii 96793

Dear Mr. Munekiyo:

SUBJECT: PROPOSED ADVANCED TECHNOLOGY CENTER AND ADVANCED TECHNOLOGY RESEARCH CENTER, TMK 2-3-08:38 AND 39 (POR.)

We have reviewed the Draft Environmental Assessment (dated March 2004) for the subject project and have no comment to offer.

Thank you for the opportunity to comment. We are returning the draft EA for your use.

Very truly yours,

Alice L. Lee

ALICE L. LEE
Director

ETO:hs

Enclosure

c: Housing Administrator

MAR 25 2004

United States Department of Agriculture

USDA

NRCS Natural Resources Conservation Service

Our People...Our Islands...In Harmony

210 Imi Kala Street, Suite #209, Wailuku, HI 96793-2100

Date: March 24, 2004

Mr. Glenn Tadaki, Planner
Munekiyo & Hiraga, Inc.
305 High Street, Suite 104
Wailuku, Hawaii 96793

Dear Mr. Tadaki,

SUBJECT: Proposed Advanced Technology Center and Advanced Technology Research Center
TMK: 2-3-008: 038 and 039 (por)

We have reviewed the subject Draft Environmental Assessment and have no comment to offer.

Thank you for the opportunity to review this document.

Sincerely,

Neal S. Fujiwara

Neal S. Fujiwara
District Conservationist

APR 08 2004

PHONE (808) 594-1888

FAX (808) 594-1865

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

HRD04-690B

March 31, 2004

Glenn Tadaki, Planner
Munekiyo & Hiraga, Inc.
305 High Street, Suite 104
Wailuku, HI 96793

Subject: Draft Environmental Assessment for the Proposed Advanced Technology Research Center, TMK: (2) 2-3-08:38 and 39 (portion)

Dear Mr. Tadaki:

Thank for your letter dated March 19, 2004 regarding the Draft Environmental Assessment (DEA) for the Proposed Advanced Technology Center and Advanced Technology Research Center for the Institute for Astronomy (IFA) at the University of Hawaii located on a 3.4 acre site at Kula, Maui, Hawaii, TMK: (2)-2-3-08:38 and 39 (portion). Your letter requests that the Office of Hawaiian Affairs (OHA) review and comment on the proposed project.

The DEA notes that archeological surveys that were conducted for the Kulamalu project area did not locate any archeological sites or cultural artifacts on the project site. Additionally, consultations with Native Hawaiian cultural practitioners like Charles Kauluwehi Maxwell Sr. by CKM Cultural Resources[1] didn't reveal "any cultural practices, gathering or subsistence practices occurring on land within the project area."

The DEA indicates the project site "was formerly utilized as pasture and has recently been disturbed in connection with the mass grading for the Kulamula Town Center Subdivision." Photographs of the project area reveal that extensive grading and grubbing has already occurred on the site.

The IFA has an annual budget of $20 million, and receives $15 million in federal grants, which in many circumstances would trigger the 106

[1] CRM Cultural Resources were hired by the project consultants to prepare the Cultural Impact Assessment contained in Appendix D of the DEA.

Consultation Process of the National Historic Preservation Act. Given the extensive grading and grubbing that has already occurred on the site, without revealing any significant archaeological remains, it doesn't appear necessary to trigger this process. However, as the DEA indicates, if any significant cultural deposits or human burials are encountered on the site[2], work will cease in this area and the State Historic Preservation Division will be contacted.

If you have questions or concerns please contact Matthew Myers, Policy Advocate at 594-1945 or matthewm@oha.org.

'O wau iho nö,

Clyde W. Nämu'o
Administrator

---

[2] OHA staff notes that any trenching, digging or grading for four structures the ATC Building (Phase 1), Future Annex (Phase 2), Future Lecture Building (Phase 2) and the Future ATRC Building (Phase 2) may reveal cultural deposits or human remains.

APR 06 2004

ALAN M. ARAKAWA
Mayor

GLENN T. CORREA
Director

JOHN L. BUCK III
Deputy Director

(808) 270-7230
Fax (808) 270-7934

DEPARTMENT OF PARKS & RECREATION

700 Hali'a Nakoa Street, Unit 2, Wailuku, Hawaii 96793

April 1, 2004

Glenn Tadaki, Planner
Munekiyo & Hiraga, Inc.
305 High Street, Suite 104
Wailuku, Hawaii 96793

Dear Mr. Tadaki:

SUBJECT: PROPOSED ADVANCED TECHNOLOGY CENTER AND ADVANCED TECHNOLOGY RESEARCH CENTER
TMK 2-3-08:38 and 39 (por.)

We have reviewed the Draft Environmental Assessment for the subject project and have no comments concerning this project.

Thank you for the opportunity to review and comment. Should there be any questions, please contact Mr. Patrick Matsui, Chief of Parks Planning and Development, at 270-7387.

Sincerely,

GLENN T. CORREA
Director

c: Patrick Matsui, Chief of Planning and Development

APR 14 2004

DEPARTMENT OF THE ARMY
U. S. ARMY ENGINEER DISTRICT, HONOLULU
FT. SHAFTER, HAWAII 96858-5440

REPLY TO ATTENTION OF

April 12, 2004

Regulatory Branch

Mr. Glenn Tadaki, Planner
Munekiyo & Hiraga, Inc.
305 High Street, Suite 104
Wailuku, Hawaii 96793

Dear Mr. Tadaki:

This responds to your written request for review comments on the Draft Environmental Assessment (DEA) for proposed University of Hawaii Institute for Astronomy development of an Advanced Technology Center and Advanced Technology Research Center on a 3.4-acre site within the Kulamalu Commercial Subdivision in Kula, Maui (TMK 2-3-8: 38 and por. 39). We have reviewed the document with respect to the Corps' authority to issue Department of the Army (DA) permits under Section 10 of the River and Harbor Act of 1899 (33 USC 403) and Section 404 of the Clean Water Act (33 USC 1344).

Based on the information provided in the DEA, it appears that there are no waters of the United States, including wetlands, on the project site; therefore, a DA permit is not required for this activity.

Should you have questions concerning this determination, please contact Mr. Peter Galloway of my staff at 808-438-8416 (fax 808-438-4060). Written inquiries should cite File No. **200200457** and should be sent to: Regulatory Branch (CEPOH-EC-R/P. Galloway); U.S. Army Engineer District, Honolulu; Building 230; Fort Shafter, Hawaii 96858-5440.

Sincerely,

George P. Young, P.E.
Chief, Regulatory Branch

APR 1 3 2004

ALAN M. ARAKAWA
MAYOR

CARL M. KAUPALOLO
CHIEF

NEAL A. BAL
DEPUTY CHIEF

COUNTY OF MAUI
DEPARTMENT OF FIRE AND PUBLIC SAFETY

200 DAIRY ROAD
KAHULUI, MAUI, HAWAII 96732
(808) 270-7561
FAX (808) 270-7919

April 13, 2004

Munekiyo & Hiraga, Inc.
Michael T. Munekiyo, Project Manager
350 High Street, Suite 104
Wailuku, HI 96793

Subject: Advanced Technology Center, Kula, Hawaii TMK 2-3-008:038,039

Dear Mr. Munekiyo,

I have reviewed your request to comment on the subject property. At this time, I have no additional remarks. A complete construction review will be done during the permit process

Thank you for allowing me the opportunity to comment on this subject. Please feel free to contact me if you have any questions at 270-7568.

Sincerely,

Valeriano F. Martin
Captain
Fire Prevention Bureau

APR 23 2004

POLICE DEPARTMENT
COUNTY OF MAUI

ALAN M. ARAKAWA
MAYOR

OUR REFERENCE
tj
YOUR REFERENCE

55 MAHALANI STREET
WAILUKU, HAWAII 96793
(808) 244-6400
FAX (808) 244-6411

THOMAS M. PHILLIPS
CHIEF OF POLICE

KEKUHAUPIO R. AKANA
DEPUTY CHIEF OF POLICE

April 19, 2004

Mr. Michael Munekiyo, A.I.C.P.
Project Manager
Munekiyo & Hiraga, Inc.
305 High Street, Suite 104
Wailuku, HI 96793

Dear Mr. Munekiyo:

SUBJECT: Proposed Advanced Technology Center and Advanced Technology Research Center, TMK 2-3-08:38 and 39 (por.)

Thank you for your letter of March 19, 2004, requesting comments on the above subject.

We have reviewed the proposed summary and have enclosed our comments and recommendations. As always, thank you for giving us the opportunity to comment on this project.

Very truly yours,

Assistant Chief Sydney Kikuchi
for: Thomas M. Phillips
Chief of Police

Enclosure

c: Michael W. Foley, Dept. of Planning

For transmittal to Munekiyo & Hiraga. [signature] 4/16/04

TO	:	THOMAS PHILLIPS, CHIEF, MAUI POLICE DEPARTMENT
VIA	:	CHANNELS
FROM	:	RANDALL BURGESS, P.O.III, COMMUNITY POLICING
SUBJECT	:	PROPOSED ADVANCED TECHNOLOGY CENTER AND ADVANCED TECHNOLOGY RESEARCH CENTER

Sir, this To/From is being submitted in regards to police comments/recommendations to the proposed Advanced Technology Center and Advanced Technology Research Center located in the Kulamalu Town Center Subdivision (TMK 2-3-08:38 and 39).

Project review reveals the following comments:

In regards to roadways/traffic; the Kula Highway/A'apueo Parkway intersection is currently unsignalized. A project of this size will surely affect traffic at this intersection, especially during after-work/after-school hours. The traffic study enclosed within the Draft Environmental Assessment (EA) recommends the installation of a traffic signal at this intersection by the year 2005 and without project generated traffic. My knowledge of the community reveals that the vast majority of area residents do not desire a traffic signal at this intersection.

In regards to the proposed project in general; again, my knowledge of the community reveals that the vast majority of Upcountry residents strongly desire to preserve and save the Upcountry character/ambiance. The Upcountry area is comprised mostly of residential homes, small farms, pineapple cultivation, cattle ranching, and is known world-wide for it's rural/open pasture-land settings. Therefore, I suggest that the County of Maui centralize Research Center projects in non-rural areas. I further suggest that the area of the Maui High Performance Computing Center located at 550 Lipoa Parkway, Kihei, be considered as a possible project site.

In closing, I strongly suggest that this proposed project be presented to Upcountry residents via a community meeting for their review and comment.

Respectfully submitted,
Randall Burgess
Randall BURGESS #1023
041504 @ 1500 hours

Comments by Officer BURGESS in regards to the entrance of the proposed project on A'apueo Parkway and the need for a traffic signal. It's known thqt Kamehameha Schools is expanding their campus which would mean more vehicle traffic entering/exiting A'apueo Parkway From/onto Kula Highway. A'apueo Parkway is also approximately 150 yards from the entrance to King Kekaulike High School. A Community meeting regarding this project as well as the installation of a traffic signal, as suggested by Officer BURGESS is needed for the public's input. Though the traffic signal may assist vehicles exiting from A'apueo Parkway, it could also cause a back-up of traffic on Kula Hwy. at the "Old" Haleakala Hwy./By-pass intersection, for traffic heading South (Ulupalakua direction). Sgt. [signature] 4/16/04

Concur,
I do not believe this project is a good fit for this community. [signature]

MUNEKIYO & HIRAGA, INC.

May 14, 2004

Thomas Phillips, Chief
Maui Police Department
55 Mahalani Street
Wailuku, Hawaii 96793

SUBJECT: Proposed Advanced Technology Center and Advanced Technology Research Center; TMK 2-3-08: 38 and 39 (por.)

Dear Mr. Phillips:

Thank you for your April 19, 2004 letter commenting on the subject's Draft Environmental Assessment (EA). On behalf of the applicant, the University of Hawaii, Institute for Astronomy (IFA), we would like to note the following.

1. As indicated by the IFA project's traffic engineer, the Draft Traffic Impact Analysis for the Kamehameha Schools Maui Campus, prepared by Phillip Rowell and Associates, (dated June 20, 2002) indicated that a traffic signal system is warranted at the Kula Highway/A`apueo Parkway intersection during the existing PM peak hour of traffic. A traffic signal would still be warranted even without the expansion of the Kamehameha Schools Maui Campus or any other proposed developments within the Kulamalu area.

   Since the traffic signal is warranted under the Kamehameha Schools expansion traffic study, the Traffic Impact Analysis Report (TIAR) for the IFA project assumed that the traffic signal system at the Kula Highway/A`apueo Parkway intersection would be installed prior to completion of the IFA project. It is our understanding that a traffic signal system at the Kula Highway/A`apueo Parkway intersection is currently being designed, and will be constructed once all regulatory approvals have been obtained.

   The proposed traffic signal system at Kula Highway/A`apueo Parkway should be interconnected with the traffic signal system at the Kula Highway/Haleakala High-way/Old Haleakala Highway intersection so that the two intersections can be coordinated with one another.

2. The proposed project is consistent with, and a continuation of, the IFA's historic use and presence in the Kula region. The proposed project site is designated for

Business/Commercial uses by the Makawao-Pukalani-Kula Community Plan land use map and for Country Town Business District uses by Maui County zoning (buildings and premises used by government agencies are a permitted use within this zoning district). The existing IFA laboratory in the Waiakoa area of Kula has been in operation since the mid-1960s and serves as a support/base station for work at the observatories on the summit of Haleakala. The proposed and existing IFA facilities are roughly equidistant to the observatories at the summit. IFA researchers check in at the Waiakoa laboratory to perform administrative tasks before and after traveling to the observatories atop Haleakala. Round trip travel between the Waiakoa laboratory and the summit takes about 1 hour and 30 minutes, while round trip travel between the Maui High Performance Computing Center in Kihei takes approximately 4 hours. The incremental difference in round trip travel between Kihei and the summit (2 hours and 30 minutes) results in irretrievable impacts to IFA operations in terms of lost time, productivity, and labor costs. In light of the foregoing, the proposed project site is deemed optimal in terms of an appropriate location for the IFA's operations and is consistent with the community plan and zoning designations for the site.

3. A meeting with Kula Community Association Board of Directors was held on May 11th, to discuss the proposed project. At this meeting, there were no comments or concerns regarding the installation of the traffic signal at the Kula Highway/A`apueo Parkway intersection.

Thank you again for providing us with your comments. Please feel free to call me should you have any questions.

Very truly yours,

Tadaki

Glenn Tadaki, Planner

GT:yp

cc: Jan Yokota, University of Hawaii
Don Fujimoto, Kulamalu Science, LLC
Keith Niiya, Austin Tsutsumi & Associates

dowling\astronmy\mpd.deares

LINDA LINGLE
GOVERNOR OF HAWAII

GENEVIEVE SALMONSON
DIRECTOR

STATE OF HAWAII
OFFICE OF ENVIRONMENTAL QUALITY CONTROL

235 SOUTH BERETANIA STREET
SUITE 702
HONOLULU, HAWAII 96813
TELEPHONE (808) 586-4185
FACSIMILE (808) 586-4186
E-mail: oeqc@health.state.hi.us

April 21, 2004

Jan Yokota
University of Hawaii
1951 East-West Road
Honolulu, Hawaii 96822

Dear Ms. Yokota:

Subject: Draft environmental assessment (EA) for **Advanced Technology Center & Advanced Technology Research Center**, Kulamalu, Maui

We have the following comments to offer:

Community meeting: A community informational meeting was mentioned in the response to the pre-consultation letter from Elliott Krash of the Kula Community Association. In the final EA give the date of its occurrence and a synopsis of the issues raised.

Sustainable building techniques: Please consider applying sustainable building techniques presented in the "Guidelines for Sustainable Building Design in Hawaii." In the final EA include a description of any of the techniques you will implement. Go to our website at *http://www.state.hi.us/health/oeqc/guidance/sustainable.htm* or contact our office for a paper copy of the guidelines.

If you have any questions, call Nancy Heinrich at 586-4185.

Sincerely,

Genevieve Salmonson

GENEVIEVE SALMONSON
Director

c: Glenn Tadaki

MUNEKIYO & HIRAGA, INC.

June 16, 2004

Genevieve Salmonson, Director
Office of Environmental Quality Control
235 South Beretania Street, Suite 702
Honolulu, Hawaii 96813

SUBJECT: Proposed Advanced Technology Center and Advanced Technology Research Center; TMK 2-3-08: 38 and 39 (por.)

Dear Ms. Salmonson:

Thank you for your April 21, 2004 letter commenting on the subject's Draft Environmental Assessment (EA). On behalf of the applicant, the University of Hawaii, Institute for Astronomy, we would like to note the following.

A meeting with the Kula Community Association's Board of Directors was held on May 11th to discuss the proposed project. A summary of this meeting will be included in the Final EA. Insofar as building design is concerned, appropriate measures from the *"Guidelines for Sustainable Building Design in Hawaii"* will be included in the Final EA.

Thank you again for providing us with your comments. Please feel free to call me should you have any questions.

Very truly yours,

Glenn Tadaki, Planner

GT:yp
cc: Jan Yokota, University of Hawaii
Don Fujimoto, Kulamalu Science, LLC
dowling\astronmy\oeqc.deares

planning . environment

305 High Street, Suite 104 · Wailuku, Hawaii 96793 · ph: (808)244-2015 · fax: (808)244-8729 · planning@mhinconline.com

APR 23 2004

ALAN M. ARAKAWA
Mayor

MICHAEL W. FOLEY
Director

WAYNE A. BOTEILHO
Deputy Director

COUNTY OF MAUI
DEPARTMENT OF PLANNING

April 21, 2004

Mr. Glenn Tadaki
Munekiyo & Hiraga
305 High Street, Suite 104
Wailuku, Hawaii 96793

Dear Mr. Tadaki:

RE: Review of the Draft Environmental Assessment Prepared for the Proposed Advanced Technology Center and Advanced Technology Research Center located at TMK: 2-3-008: 038 and 039 (portion), Kulamalu Town Center, Kula, Island of Maui, Hawaii (LTR 2004/1035)

The Maui Planning Department (Department) has reviewed the Draft Environmental Assessment (DEA) prepared in accordance with Chapter 343, HRS, and Title 11, Chapter 200, HAR, and offers the following comments:

1. Discuss the water and wastewater allocation for the proposed use as it relates to the pre-determined, anticipated capacities for the entire subdivision.

2. Although unknown at the present time, the report states that maintenance and operations activities may require the use of hazardous substances of which will be managed and disposed of in accordance with the Resource Conservation and Recovery Act (RCRA). Consumer sized quantities of such substances may be permissible for building maintenance activities. Unless related to educational uses, please be advised that bulk quantities of such substances associated with proposed uses (e.g., manufacturing/ fabrication of parts) would not be permissible in the zoning district. The Department further notes that chemical testing laboratories are not permitted within the zoning district unless limited to educational purposes only.

   In review our records for the Kulamalu Town Center's CC&R's and Design Guidelines, the Department notes that the use, storage, generation, or disposal of hazardous materials are not permitted within the subdivision, except when associated with an automobile service station or other materials routinely sold at retail in stores.

3. The project design should incorporate low level lighting on the building and within the landscaped areas. Further, the parking lot lighting should be fully shielded.

4. Discuss proposed energy conservation measures utilized in the project design.

5. Identify the federal, state, and/or county funding sources for the proposed project and for continued operation of the facility.

6. Label "Ohi'a Ku Roadway" on the Site Plan in Appendix A.

7. Page 7 of the report indicates the scope of the DEA is for both Phase 1 and 2 of the project. As such, Appendix A should include the exterior elevations and floor plans for both buildings proposed in Phase 2.

Thank you for your cooperation. Should you require additional clarification, please contact Ms. Kivette A. Caigoy, Environmental Planner, of my office at 270-7735.

Sincerely,

M. W. Foley

MICHAEL W. FOLEY
Planning Director

MWF:KAC:lar
c: Wayne Boteilho, Deputy Planning Director
Clayton Yoshida, Planning Program Administrator
Kivette A. Caigoy, Environmental Planner
OEQC
General File
K:\WP_DOCS\PLANNING\EA\DEAComments\2004\1035_ATC_KulamaluSubd.wpd

MUNEKIYO & HIRAGA, INC.

May 14, 2004

Michael W. Foley, Director
Department of Planning
County of Maui
250 South High Street
Wailuku, Hawaii 96793

SUBJECT: Proposed Advanced Technology Center and Advanced Technology Research Center; TMK 2-3-08: 38 and 39 (por.)

Dear Mr. Foley:

Thank you for your April 21, 2004 letter commenting on the subject's Draft Environmental Assessment (EA). On behalf of the applicant, the University of Hawaii, Institute for Astronomy (IFA), we would like to note the following.

1. The applicant has a source allocation of approximately 738,000 gallons per day (gpd) for its contribution to the development of a new well in Kaupakalua to supplement the County's surface source for the Makawao-Pukalani water system. A portion of this allocation will be utilized by the IFA to accommodate the project's estimated average daily demand of 6,200 gpd at full build-out. The applicant also has a capacity allocation of approximately 75,000 gpd at the Pukalani Terrace sewage treatment plant, a privately operated facility. A portion of this allocation will be used by the IFA to accommodate the estimated 5,500 gpd of wastewater generated by the project at full build-out.

2. As indicated by the IFA, no significant amounts of hazardous substances will be stored and utilized at the proposed facility. Small amounts of cutting oil (for machining precision instruments) and optical grade alcohol (for optics cleaning) will be utilized for facility operations, while consumer-sized quantities of cleaning materials will be used for routine facility maintenance. No vehicle servicing and maintenance activities will occur at the project site as these activities will be handled at the IFA's existing Waiakoa facility. The proposed facility is for research and educational work and does not include a chemical testing laboratory as a component. The proposed project is consistent with the Makawao-Pukalani-Kula Community Plan (Business/Commercial) and Maui Country zoning (Country Town Business District) designations for the site.

305 High Street, Suite 104 · Wailuku, Hawaii 96793 · ph: (808)244-2015 · fax: (808)244-8729 · planning@mhinconline.com
environment planning government

It is noted that Country Town Business District zoning allows buildings and premises used by government agencies as a permitted use.

The use, handling, and disposal of hazardous materials will be conducted in accordance with the University of Hawaii's Environmental Health and Safety Office standards. The proposed project is not contrary to the CC&Rs and Design Guidelines for the Kulamalu Town Center as the intent of these provisions is to restrict facilities which routinely utilize large quantities of hazardous materials in connection with their operational and maintenance activities. The CC&Rs and Design Guidelines will be reviewed, and revised as necessary, to clarify the intent of the provisions regarding hazardous materials.

3. Parking lot light poles will be fully shielded and appropriate low-level lighting fixtures will be utilized for the project's buildings and landscaping.

4. Energy efficient measures considered for the project include the use of energy efficient windows, water heaters, and light fixtures, as well as automated light sensors and temperature controls, fiberglass insulation in the building's walls and ceilings, and the use of weatherstripping and low-flow plumbing fixtures.

5. Funds appropriated by the State legislature will be used for the construction of the project. The use of the proposed facility will be funded through monies from the University of Hawaii's operating budget.

6. The site plan in Appendix A will be revised to identify Ohi`a Ku Street.

7. The preparation of floor plans and building elevations for Phase II is contingent upon State funding for the acquisition of Lot 17. Notwithstanding this, the Draft EA evaluated the project based upon the full build-out of Phases I and II.

Thank you again for providing us with your comments. Please feel free to call me should you have any questions.

Very truly yours,

Glenn Tadaki, Planner

cc: Jan Yokota, University of Hawaii
Don Fujimoto, Kulamalu Science, LLC

dowling\astronmy\dop.deares

APR 2 6 2004

LINDA LINGLE
GOVERNOR OF HAWAII

STATE OF HAWAII
DEPARTMENT OF HEALTH
P.O. Box 3378
HONOLULU, HAWAII 96801-3378

CHIYOME L. FUKINO, M.D.
DIRECTOR OF HEALTH

In reply, please refer to:
EPO-04-060

April 23, 2004

Mr. Michael Munekiyo
Munekiyo & Hiraga, Inc.
305 High Street, Suite 104
Wailuku, Hawaii 96793

Dear Mr. Munekiyo:

SUBJECT: Proposed Advanced Technology Center and Advanced Technology Research center, TMK 2-3-008:38 and 39 (por.)

Thank you for allowing us to review and comment on the subject document. We have the following comments to offer. If you have any questions about these comments please contact Ryan Davenport at 586-4346.

Clean Water Branch Standard Comments

1. The Army Corps of Engineers should be contacted at (808) 438-9258 to identify whether a Federal license or permit (including a Department of Army permit) is required for this project. Pursuant to Section 401(a)(1) of the Federal Water Pollution Act (commonly known as the "Clean Water Act"), a Section 401 Water Quality Certification is required for "[a]ny applicant for Federal license or permit to conduct any activity including, but not limited to, the construction or operation of facilities, which may result in any discharge into the navigable waters...."

2. A National Pollutant Discharge Elimination System (NPDES) general permit coverage is required for the following activities:

    a. Storm water associated with industrial activities, as defined in Title 40, Code of Federal Regulations, Sections 122.26(b)(14)(i) through 122.26(b)(14)(ix) and 122.26(b)(14)(xi).

    b. Construction activities, including clearing, grading, and excavation, that result in the disturbance of equal to or greater than one (1) acre of total land area. The total land area includes a contiguous area where multiple separate and distinct construction activities may be taking place at different times on different schedules under a larger common plan of development or sale. **An NPDES permit is required before the commencement of the construction activities.**

c. Discharges of treated effluent from leaking underground storage tank remedial activities.

d. Discharges of once through cooling water less than one (1) million gallons per day.

e. Discharges of hydrotesting water.

f. Discharges of construction dewatering effluent.

g. Discharges of treated effluent from petroleum bulk stations and terminals.

h. Discharges of treated effluent from well drilling activities.

i. Discharges of treated effluent from recycled water distribution systems.

j. Discharges of storm water from a small municipal separate storm sewer system.

k. Discharges of circulation water from decorative ponds or tanks.

The CWB requires that a Notice of Intent (NOI) to be covered by a NPDES general permit for any of the above activities be submitted at least 30 days before the commencement of the respective activities. The NOI forms may be picked up at our office or downloaded from our website at http://www.state.hi.us/health/eh/cwb/forms/genl-index.html.

3. The applicant may be required to apply for an individual NPDES permit if there is any type of activity in which wastewater is discharged from the project into State waters and/or coverage of the discharge(s) under the NPDES general permit(s) is not permissible (i.e. NPDES general permits do not cover discharges into Class 1 or Class AA receiving waters). An application for the NPDES permit is to be submitted at least 180 days before the commencement of the respective activities. The NPDES application forms may also be picked up at our office or downloaded from our website at http://www.state.hi.us/health/eh/cwb/forms/indiv-index.html.

4. Hawaii Administrative Rules, Section 11-55-38, also requires the owner to either submit a copy of the new NOI or NPDES permit application to the State Department of Land and Natural Resources, State Historic Preservation Division (SHPD), or demonstrate to the satisfaction of the DOH that the project, activity, or site covered by the NOI or application has been or is being reviewed by SHPD. Please submit a copy of the request for review by SHPD or SHPD's determination letter for the project.

If you have any questions, please contact the CWB at 586-4309.

Wastewater Branch

We have reviewed the subject document which proposes the development of an Advanced Technology Center (ATC) and an Advanced Technology Research Center (ATRC) on a 3.4 acre site at Kula, Maui, Hawaii.

We have the following comments to offer. The subject project is located in the Critical Wastewater Disposal Area (CWDA) as determined by the Maui County Wastewater Advisory Committee where no new cesspools will be allowed. As wastewater treatment and disposal will be handled by connection to the Pukalani Wastewater Treatment Plant, we have no objections to the proposed project.

All wastewater plans must conform to applicable provisions of the Department of Health's Administrative Rules, Chapter 11-62, "Wastewater Systems." We do reserve the right to review the detailed wastewater plans for conformance to applicable rules. Should you have any questions, please contact the Planning & Design Section of the Wastewater Branch at telephone (808)586-4294.

Solid and Hazardous Waste Branch

1. The OSWM recommends the development of a solid waste management plan that encompasses all project phases including demolition, construction, and occupation of the buildings.

   Specific examples of elements that the plan should address include:
   - Recycling construction and demolition wastes, if appropriate;
   - The use of locally produced compost in landscaping;
   - The use of recycled content building materials;
   - The provision of recycling facilities in the design of the project.

The developer shall ensure that all solid waste generated during project construction is directed to a Department of Health permitted solid waste disposal or recycling facility.

If there are any questions please contact the Solid and Hazardous Waste Branch at 586-4226.

Noise Radiation and Indoor Air Quality

"Project activities shall comply with the Administrative Rules of the Department of Health:

- Chapter 11-46 Community Noise Control.

Should there be any questions, please contact Russell S. Takata, Environmental Health Program Manager, Noise, Radiation and Indoor Air Quality Branch, at 586-4701."

Sincerely,

June F. Harrigan-Lum

JUNE F. HARRIGAN-LUM, MANAGER
Environmental Planning Office

c: CWB
NRAIQ
WWB
SHWB

MUNEKIYO & HIRAGA, INC.

April 30, 2004

June F. Harrigan-Lum, Manager
Environmental Planning Office
Department of Health
P.O. Box 3378
Honolulu, Hawaii 96801-3378

SUBJECT: Proposed Advanced Technology Center and Advanced Technology Research Center; TMK 2-3-08: 38 and 39 (por.)

Dear Ms. Harrigan-Lum:

Thank you for your April 23, 2004 letter commenting on the subject's Draft Environmental Assessment (EA). On behalf of the applicant, the University of Hawaii, Institute for Astronomy, we would like to note the following.

A copy of the Draft EA was provided to the U.S. Army Corps of Engineers for review and comment. Based on its review of the Draft EA, the Corps of Engineers indicated that a Department of the Army permit is not required for the proposed activity.

NPDES general permit coverage will be obtained prior to the start of construction. In addition to acknowledging the department's comments about solid waste disposal and management, the applicant will work with the contractor to ensure that the project is implemented in accordance with the applicable provisions of Chapter 11-62 (Wastewater Systems) and Chapter 11-46 (Community Noise Control).

305 High Street, Suite 104 · Wailuku, Hawaii 96793 · ph: (808)244-2015 · fax: (808)244-8729 planning@mhinconline.com

Thank you again for providing us with your comments and please feel free to call me should you have any questions.

Very truly yours,

Glenn Tadaki, Planner

GT:yp
cc: Jan Yokota, University of Hawaii
Don Fujimoto, Kulamalu Science, LLC
dowling\astronmy\doh.de4res

APR 27 2004

LINDA LINGLE
GOVERNOR OF HAWAII

CHIYOME L. FUKINO, M.D.
DIRECTOR OF HEALTH

LORRIN W. PANG, M.D., M.P.H.
DISTRICT HEALTH OFFICER

STATE OF HAWAII
DEPARTMENT OF HEALTH
MAUI DISTRICT HEALTH OFFICE
54 HIGH STREET
WAILUKU, MAUI, HAWAII 96793-2102

April 26, 2004

Mr. Glenn Tadaki
Munekiyo & Hiraga, Inc.
305 South High Street, Suite 104
Wailuku, Hawai`i 96793

Dear Mr. Tadaki:

Subject: **Proposed Advanced Technology Center and Advanced Technology Research Center**
TMK: (2) 2-3-08:38 and 39 (por.)

Thank you for the opportunity to comment on the Draft Environmental Assessment for the proposed technology center. The following comments are offered:

1. The noise created during the construction phase of the project may exceed the maximum allowable levels as set forth in Hawaii Administrative Rules (HAR), Chapter 11-46 "Community Noise Control". A noise permit may be required and should be obtained before the commencement of work.

2. HAR, Chapter 11-46 sets maximum allowable sound levels from stationary equipment such as compressors and HVAC equipment. The attenuation of noise from these sources may depend on the location and placement of these types of equipment. This should be taken into consideration during the planning, design, and construction of the building and installation of these types of equipment.

3. National Pollutant Discharge Elimination System (NPDES) permit coverage is required for this project. The Clean Water Branch should be contacted at 808 586-4309.

4. Due to the nature and location of the project, there is a significant potential for fugitive dust emissions during site work preparations. It is recommended that a dust control management plan be developed. Implementation of adequate dust control measures during all phases of the project is warranted. Construction activities must comply with the provisions of HAR, Chapter 11-60.

Mr. Glenn Tadaki
April 26, 2004
Page 2

5. The property may be harboring rodents that will be dispersed to the surrounding areas when the site is cleared. The applicant is required by Hawaii Administrative Rules, Chapter 11-26, "Vector Control" to eradicate any rodents prior to demolition or site clearing activities and to notify the Department of Health by submitting Form VC-12 to the Maui Vector Control program when such action is taken. Rodent traps and/or rodenticides should be set out on the project site for at least a week or until the rodent activity ceases. The Maui Vector Control program phone number is 873-3560.

Should you have any questions, please call me at 984-8230.

Sincerely,

Herbert S. Matsubayashi
District Environmental Health Program Chief

MUNEKIYO & HIRAGA, INC.

April 30, 2004

Herbert S. Matsubayashi, District
Environmental Health Program Chief
Department of Health
State of Hawaii
54 High Street
Wailuku, Hawaii 96793

SUBJECT: Proposed Advanced Technology Center and Advanced Technology Research Center; TMK 2-3-08: 38 and 39 (por.)

Dear Mr. Matsubayashi:

Thank you for your April 26, 2004 letter commenting on the subject's Draft Environmental Assessment (EA). On behalf of the applicant, the University of Hawaii, Institute for Astronomy, we would like to note the following.

The construction of the project will be in accordance with the applicable provisions of Chapter 11-46 (Community Noise Control), Chapter 11-60 (Air Pollution Control), and Chapter 11-26 (Vector Control), as well as NPDES requirements for permit coverage.

Thank you again for providing us with your comments and please feel free to call me should you have any questions.

Very truly yours,

Glenn Tadaki, Planner

GT:yp
cc: Jan Yokota, University of Hawaii
Don Fujimoto, Kulamalu Science, LLC
dowling\astronmy\dohmaul.deares

305 High Street, Suite 104 · Wailuku, Hawaii 96793 · ph: (808)244-2015 · fax: (808)244-8729 planning@mhinconline.com

APR 29 2004

LINDA LINGLE
GOVERNOR OF HAWAII

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

PETER T. YOUNG
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

DAN DAVIDSON
DEPUTY DIRECTOR - LAND

ERNEST Y.W. LAU
DEPUTY DIRECTOR - WATER

AQUATIC RESOURCES
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HISTORIC PRESERVATION
KAHOOLAWE ISLAND RESERVE COMMISSION
LAND
STATE PARKS

April 28, 2004

LD-NAV
UHMAUITECHCTN.RCM

Munekiyo and Hiraga, Inc.
Michael T. Munekiyo, A.I.C.P.
Project Manager
305 High Street, Suite 104
Wailuku, Hawaii 96793

Dear Mr. Munekiyo:

SUBJECT: Draft Environmental Assessment for the Proposed Advance Technology Center and Advance Technology Research Center
TMK: (2) 2-3-008 and 009 (portion)

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 the subject Draft Environmental Assessment to the following DLNR Divisions for their review and comment:

- Division of Forestry and Wildlife
- Division of State Parks
- Engineering Division
- Commission on Water Resource Management
- Office of Conservation and Coastal Lands
- Land-Maui District Land Office
- Land-Planning and Development
- Land-Project Development Specialist

Enclosed please find a copy of the Engineering Division comment.

Based on the attached responses, the Department of Land and Natural Resources has no other comment to offer.

If you have any questions, please feel free to contact Nicholas A. Vaccaro of the Land Division Support Services Branch at 1-808-587-0384.

Very truly yours,

DIERDRE S. MAMIYA
Administrator

C: MDLO

2628

LINDA LINGLE
GOVERNOR OF HAWAII

DIV. STATE PARKS
APR 6 1 52 PM '04

RECEIVED
LAND DIVISION
2004 APR 16 P 1:58

PETER T. YOUNG
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

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ERNEST Y.W. LAU
DEPUTY DIRECTOR - WATER

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BUREAU OF CONVEYANCES
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ENGINEERING
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION
KAHOOLAWE ISLAND RESERVE COMMISSION
LAND
STATE PARKS

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION
POST OFFICE BOX 621
HONOLULU, HAWAII 96809

DEPT. OF LAND & NATURAL RESOURCES STATE OF HAWAII

April 2, 2004

LD/NAV
Ref.: UHMAUITECHCTN.CMT

L-1772
Suspense Date: 4/13/04

ADMINISTRATOR
ASST ADMIN
DEV BR
PLAN BR
... BR
CLERICAL
... ASST
INTERP BR
FOR:
CIRC/POST/STAFF RM
(✓) COMMENTS & REC
DRAFT REPLY
FILE
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INFO
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MEMORANDUM:

TO:
Division of Aquatic Resources
*XXX Division of Forestry & Wildlife
*XXX Division of State Parks
Na Ala Hele Trails
Division of Boating and Ocean Recreation
*XXX Commission on Water Resource Management
*XXX Office of Conservation and Coastal Lands
*XXX Engineering Division
*XXX Land-Maui District Land Office (DD)
*XXX Land-Planning and Development
*XXX Land-Project Development Specialist

FROM: Dierdre S. Mamiya, Administrator
Land Division

SUBJECT: Proposed Advance Technology Center and Advance Technology Research Center. TMK: (2) 2-3-008 and 009 Portion
Applicant: University of Hawaii
Consultant: Munekiyo & Hiraga, Inc. (808-244-2015)

Please review the document pertaining to the subject matter and submit your comment (if any) on Division letterhead signed and dated by the suspense date.

***NOTE: One copy of the document is available for your review in the Land Division Office, Room 220.**

Should you need more time to review the document, please contact Nick Vaccaro at ext.: 7-0438.

If this office does not receive your comments by the suspense date, we will assume there are no comments.

(✓) We have no comments. ( ) Comments attached.

Signed:
State Parks Administrator

LINDA LINGLE
GOVERNOR OF HAWAII

PETER T. YOUNG
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

DAN DAVIDSON
DEPUTY DIRECTOR - LAND

ERNEST Y.W. LAU
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
LAND DIVISION

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

April 2, 2004

L-1772

LD/NAV
Ref.: UHMAUITECHCTN.CMT

Suspense Date: 4/13/04

RECEIVED
LAND DIVISION
2004 APR 15 A 9:39
DEPT. OF LAND & NATURAL RESOURCES
STATE OF HAWAII

MEMORANDUM:

TO:
Division of Aquatic Resources
*XXX Division of Forestry & Wildlife
*XXX Division of State Parks
Na Ala Hele Trails
Division of Boating and Ocean Recreation
*XXX Commission on Water Resource Management
*XXX Office of Conservation and Coastal Lands
*XXX Engineering Division
*XXX Land-Maui District Land Office (DD)
*XXX Land-Planning and Development
*XXX Land-Project Development Specialist

FROM: Dierdre S. Mamiya, Administrator
Land Division

SUBJECT: Proposed Advance Technology Center and Advance Technology Research Center. TMK: (2) 2-3-008 and 009 Portion
Applicant: University of Hawaii
Consultant: Munekiyo & Hiraga, Inc. (808-244-2015)

Please review the document pertaining to the subject matter and submit your comment (if any) on Division letterhead signed and dated by the suspense date.

***NOTE: One copy of the document is available for your review in the Land Division Office, Room 220.**

Should you need more time to review the document, please contact Nick Vaccaro at ext.: 7-0438.

If this office does not receive your comments by the suspense date, we will assume there are no comments.

(✓) We have no comments.

( ) Comments attached.

Signed:

LINDA LINGLE
GOVERNOR OF HAWAII

RECEIVED
LAND DIVISION

2004 APR 12 P 3:57

DEPT. OF LAND & NATURAL RESOURCES
STATE OF HAWAII

PETER T. YOUNG
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

DAN DAVIDSON
DEPUTY DIRECTOR - LAND

ERNEST Y.W. LAU
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
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FORESTRY AND WILDLIFE
HISTORIC PRESERVATION
KAHOOLAWE ISLAND RESERVE COMMISSION
LAND
STATE PARKS

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

April 2, 2004

LD/NAV
Ref.: UHMAUITECHCTN.CMT

L-1772
Suspense Date: 4/13/04

MEMORANDUM:

TO:
Division of Aquatic Resources
*XXX Division of Forestry & Wildlife
*XXX Division of State Parks
Na Ala Hele Trails
Division of Boating and Ocean Recreation
*XXX Commission on Water Resource Management
*XXX Office of Conservation and Coastal Lands
*XXX Engineering Division
*XXX Land-Maui District Land Office (DD)
*XXX Land-Planning and Development
*XXX Land-Project Development Specialist

FROM: Dierdre S. Mamiya, Administrator
Land Division

SUBJECT: Proposed Advance Technology Center and Advance Technology Research Center. TMK: (2) 2-3-008 and 009 Portion
Applicant: University of Hawaii
Consultant: Munekiyo & Hiraga, Inc. (808-244-2015)

Please review the document pertaining to the subject matter and submit your comment (if any) on Division letterhead signed and dated by the suspense date.

***NOTE: One copy of the document is available for your review in the Land Division Office, Room 220.**

Should you need more time to review the document, please contact Nick Vaccaro at ext.: 7-0438.

If this office does not receive your comments by the suspense date, we will assume there are no comments.

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

Signed:

MICHAEL G. BUCK, ADMINISTRATOR
DIVISION OF FORESTRY AND WILDLIFE

APR - 6 2004

LINDA LINGLE
GOVERNOR OF HAWAII

RECEIVED
LAND DIVISION

2004 APR 12 P 2:26

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

PETER T. YOUNG
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

DAN DAVIDSON
DEPUTY DIRECTOR - LAND

ERNEST Y.W. LAU
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

April 2, 2004 4/6

L-1772

LD/NAV
Ref.: UHMAUITECHCTN.CMT

Suspense Date: 4/13/04

MEMORANDUM:

TO:
Division of Aquatic Resources
*XXX Division of Forestry & Wildlife
*XXX Division of State Parks
Na Ala Hele Trails
Division of Boating and Ocean Recreation
*XXX Commission on Water Resource Management
*XXX Office of Conservation and Coastal Lands
*XXX Engineering Division
*XXX Land-Maui District Land Office (DD)
*XXX Land-Planning and Development
*XXX Land-Project Development Specialist

FROM: Dierdre S. Mamiya, Administrator
Land Division

SUBJECT: Proposed Advance Technology Center and Advance Technology Research Center. TMK: (2) 2-3-008 and 009 Portion
Applicant: University of Hawaii
Consultant: Munekiyo & Hiraga, Inc. (808-244-2015)

Please review the document pertaining to the subject matter and submit your comment (if any) on Division letterhead signed and dated by the suspense date.

***NOTE: One copy of the document is available for your review in the Land Division Office, Room 220.**

Should you need more time to review the document, please contact Nick Vaccaro at ext.: 7-0438.

If this office does not receive your comments by the suspense date, we will assume there are no comments.

( ) We have no comments.

(✓) Comments attached.

Signed:

DEPARTMENT OF LAND AND NATURAL RESOURCES
ENGINEERING DIVISION

LA/NAV

Ref.: UHMAUITECHCTN.CMT

COMMENTS

(X) ***We confirm that the project site, according to the Flood Insurance Rate Map (FIRM), is located in Flood Zone C.***

( ) Please take note that the project site, according to the Flood Insurance Rate Map (FIRM), is located in Zone ___.

( ) Please note that the correct Flood Zone Designation for the project site according to the Flood Insurance Rate Map (FIRM) is ___.

( ) Please note that the project must comply with the rules and regulations of the National Flood Insurance Program (NFIP) presented in Title 44 of the Code of Federal Regulations (44CFR), whenever development within a Special Flood Hazard Area is undertaken. If there are any questions, please contact the State NFIP Coordinator, Ms. Carol Tyau-Beam, of the Department of Land and Natural Resources, Engineering Division at (808) 587-0267.

Please be advised that 44CFR indicates the minimum standards set forth by the NFIP. Your Community's local flood ordinance may prove to be more restrictive and thus take precedence over the minimum NFIP standards. If there are questions regarding the local flood ordinances, please contact the applicable County NFIP Coordinators below:

( ) Mr. Robert Sumimoto at (808) 523-4254 or Mr. Mario Siu Li at (808) 523-4247 of the City and County of Honolulu, Department of Planning and Permitting.

( ) Mr. Kelly Gomes at (808) 961-8327 (Hilo) or Mr. Kiran Emler at (808) 327-3530 (Kona) of the County of Hawaii, Department of Public Works.

( ) Mr. Francis Cerizo at (808) 270-7771 of the County of Maui, Department of Planning.

( ) Mr. Mario Antonio at (808) 241-6620 of the County of Kauai, Department of Public Works.

( ) The applicant should include project water demands and infrastructure required to meet water demands. Please note that the implementation of any State-sponsored projects requiring water service from the Honolulu Board of Water Supply system must first obtain water allocation credits from the Engineering Division before it can receive a building permit and/or water meter.

( ) The applicant should provide the water demands and calculations to the Engineering Division so it can be included in the State Water Projects Plan Update.

( ) Additional Comments: ____________________

( ) Other: ____________________

Should you have any questions, please call Mr. Andrew Monden of the Planning Branch at 587-0229.

Signed: Andrew M. Monden
for ERIC T. HIRANO, CHIEF ENGINEER

Date: 4/8/04

LINDA LINGLE
GOVERNOR OF HAWAII

RECEIVED
04 APR 6 A10:15
WATER RESOURCE MANAGEMENT

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION
POST OFFICE BOX 621
HONOLULU, HAWAII 96809

PETER T. YOUNG
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

DAN DAVIDSON
DEPUTY DIRECTOR - LAND

ERNEST Y.W. LAU
DEPUTY DIRECTOR - WATER

AQUATIC RESOURCES
BOATING AND OCEAN RECREATION
BUREAU OF CONVEYANCES
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FORESTRY AND WILDLIFE
HISTORIC PRESERVATION
KAHOOLAWE ISLAND RESERVE COMMISSION
LAND
STATE PARKS

April 2, 2004

L-1772

LD/NAV
Ref.: UHMAUITECHCTN.CMT

Suspense Date: 4/13/04

MEMORANDUM:

TO:
Division of Aquatic Resources
*XXX Division of Forestry & Wildlife
*XXX Division of State Parks
Na Ala Hele Trails
Division of Boating and Ocean Recreation
*XXX Commission on Water Resource Management
*XXX Office of Conservation and Coastal Lands
*XXX Engineering Division
*XXX Land-Maui District Land Office (DD)
*XXX Land-Planning and Development
*XXX Land-Project Development Specialist

RECEIVED
LAND DIVISION
2004 APR 14 A 9:33
DEPT. OF LAND & NATURAL RESOURCES
STATE OF HAWAII

FROM: Dierdre S. Mamiya, Administrator
Land Division

SUBJECT: Proposed Advance Technology Center and Advance Technology Research Center. TMK: (2) 2-3-008 and 009 Portion
Applicant: University of Hawaii
Consultant: Munekiyo & Hiraga, Inc. (808-244-2015)

Please review the document pertaining to the subject matter and submit your comment (if any) on Division letterhead signed and dated by the suspense date.

***NOTE: One copy of the document is available for your review in the Land Division Office, Room 220.**

Should you need more time to review the document, please contact Nick Vaccaro at ext.: 7-0438.

If this office does not receive your comments by the suspense date, we will assume there are no comments.

(X) We have no comments.

( ) Comments attached.

Signed: Dan Moriyama

LINDA LINGLE
GOVERNOR OF HAWAII

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

April 2, 2004

L-1772

LD/NAV
Ref.: UHMAUITECHCTN.CMT

Suspense Date: 4/13/04

MEMORANDUM:

TO:
Division of Aquatic Resources
*XXX Division of Forestry & Wildlife
*XXX Division of State Parks
Na Ala Hele Trails
Division of Boating and Ocean Recreation
*XXX Commission on Water Resource Management
*XXX Office of Conservation and Coastal Lands
*XXX Engineering Division
*XXX Land-Maui District Land Office (DD)
*XXX Land-Planning and Development
*XXX Land-Project Development Specialist

FROM: Dierdre S. Mamiya, Administrator
Land Division

SUBJECT: Proposed Advance Technology Center and Advance Technology Research Center. TMK: (2) 2-3-008 and 009 Portion
Applicant: University of Hawaii
Consultant: Munekiyo & Hiraga, Inc. (808-244-2015)

Please review the document pertaining to the subject matter and submit your comment (if any) on Division letterhead signed and dated by the suspense date.

***NOTE: One copy of the document is available for your review in the Land Division Office, Room 220.**

Should you need more time to review the document, please contact Nick Vaccaro at ext.: 7-0438.

If this office does not receive your comments by the suspense date, we will assume there are no comments.

(X) We have no comments.

( ) Comments attached.

Signed:

4/6/04

MAY 0 5 2004

LINDA LINGLE
GOVERNOR OF HAWAII

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES

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

PETER T. YOUNG
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

DAN DAVIDSON
DEPUTY DIRECTOR - LAND

ERNEST Y.W. LAU
DEPUTY DIRECTOR - WATER

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ENGINEERING
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION
KAHOOLAWE ISLAND RESERVE COMMISSION
LAND
STATE PARKS

April 30, 2004

Glenn Tadaki
Munekiyo & Hiraga, Inc.
305 South High Street, Suite 104
Wailuku, Hawaii 96793

LOG NO: 0224.1361
DOC NO: 0404CD75

Dear Mr. Tadaki,

SUBJECT: **Chapter 6E-8 Historic Preservation Review – Draft Environmental Assessment for the Proposed Advanced Technology Center and Advanced Technology Research Center**
`A`apueo Ahupua`a, Makawao District, Island of Maui
TMK: (2) 2-3-008:038 and 039 (por.)

Thank you for the opportunity to review and comment on the Draft Environmental Assessment (Draft EA) for the Proposed Advanced Technology Center and Advanced Technology Research Center (ATRC) which was received by our staff March 22, 2004. Based on the submitted Draft EA, we understand the proposed undertaking consists of the construction of the ATRC on a 3.4 acre lot located within the Kulamalu Town Center Subdivision (aka Kulamalu Commercial Subdivision). We note that if there is Federal involvement, including funding, in the proposed action, the responsible Federal agency will need to ensure that the compliance with Section 106 of the National Historic Preservation Act has been carried out.

In 1996, PHRI conducted an archaeological inventory survey which included the proposed project area (*Archaeological Inventory Survey, 44-Acre Pukalani Terrace Subdivision III, Land of `A`apueo, Makawao District, Island of Maui.* Wulzen et al. 1996). Although four historic sites were identified during the survey, none are located in the project area. Given the above information, we believe there will be "no historic properties affected" by the proposed undertaking.

In the event that historic sites (human skeletal remains, etc.) are identified during the 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 Office needs to be contacted immediately at 243-5169, on Maui, or at (808) 692-8023, on O`ahu.

If you have any questions, please call Cathleen A. Dagher at 692-8023.

Aloha,

P. Holly McEldowney

P. Holly McEldowney, Administrator
State Historic Preservation Division

CD:jen

c: Michael Foley, Director, Dept of Planning, 250 S. High Street, Wailuku, HI 96793
Maui Cultural Resources Commission, Dept of Planning, 250 S. High Street, Wailuku, HI 96793

JUN 17 2004

ALAN M. ARAKAWA
Mayor

GILBERT S. COLOMA-AGARAN
Director

MILTON M. ARAKAWA, A.I.C.P.
Deputy Director

Telephone: (808) 270-7845
Fax: (808) 270-7955

COUNTY OF MAUI
DEPARTMENT OF PUBLIC WORKS AND ENVIRONMENTAL MANAGEMENT
200 SOUTH HIGH STREET
WAILUKU, MAUI, HAWAII 96793

RALPH NAGAMINE, L.S., P.E.
Development Services Administration

TRACY TAKAMINE, P.E.
Wastewater Reclamation Division

LLOYD P.C.W. LEE, P.E.
Engineering Division

BRIAN HASHIRO, P.E.
Highways Division

JOHN D. HARDER
Solid Waste Division

June 14, 2004

Mr. Glenn Tadaki
MUNEKIYO & HIRAGA, INC.
305 High Street Suite 104
Wailuku, Maui, Hawaii 96793

Dear Mr. Tadaki:

SUBJECT: DRAFT ENVIRONMENTAL ASSESSMENT
PROPOSED ADVANCED TECHNOLOGY CENTER AND
ADVANCED TECHNOLOGY RESEARCH CENTER
TMK: (2) 2-3-008:038, 039 (POR.)

We reviewed the Draft Environmental Assessment and have the following comments:

1. The plans submitted for this project do not adequately show sufficient detail to determine whether the project is compliant with building codes. We will review the project for building code requirements during the building permit application process.

2. The grading for the project shall comply with the provisions of the grading ordinance. Best Management Practices (BMP) shall be implemented to the maximum extent practicable to prevent pollutants including dust and sediment from discharging off the project site.

3. The drainage system design shall comply with the provisions of the drainage rules and shall create no additional adverse effects to adjacent and downstream properties.

4. A detailed and final drainage report and a Best Management Practices Plan shall be submitted with the grading plans for review

Mr. Glenn Tadaki
June 14, 2004
Page 2

and approval prior to issuance of grading permits. The drainage report shall include hydrologic and hydraulic calculations and the schemes for disposal of runoff waters. It must comply with the provisions of the "Rules and Design of Storm Drainage Facilities in the County of Maui" and must provide verification that the grading and runoff water generated by the project will not have an adverse effect on adjacent and downstream properties. The BMP plan shall show the location and details of structural and non-structural measures to control erosion and sedimentation to the maximum extent practicable.

5. A sight distance analysis for each connection onto Ohi'a Ku Street shall be submitted for review and approval.

If you have any questions regarding this letter, please call Milton Arakawa at (808) 270-7845.

Very truly yours,

Milton Arakawa

for GILBERT S. COLOMA-AGARAN
Director

GSCA:MA:sw
S:\LUCA\CZM\Draft Comments\23008038-039_Advanced Reasearch_Ctr_dea_sw.wpd

MUNEKIYO & HIRAGA, INC.

June 22, 2004

Gilbert S. Coloma-Agaran, Director
Department of Public Works
and Environmental Management
200 South High Street
Wailuku, Hawaii 96793

SUBJECT: Proposed Advanced Technology Center and Advanced Technology Research Center; TMK 2-3-08: 38 and 39 (por.)

Dear Mr. Coloma-Agaran:

Thank you for your June 14, 2004 letter commenting on the subject's Draft Environmental Assessment (EA). On behalf of the applicant, the University of Hawaii, Institute for Astronomy, we would like to note the following.

1. The applicant acknowledges that the project's compliance with building code requirements will be reviewed during the building permit application process.

2. Site grading and the implementation of Best Management Practices will be conducted in accordance with the provisions of Chapter 20.08 of the Maui County Code regarding *"Soil Erosion and Sedimentation Control"*.

3. The drainage system for the project will be designed in accordance with the *"Rules for the Design of Storm Drainage Facilities in the County of Maui"*.

4. A detailed drainage report, along with grading plans for the project, will be submitted to the department for review and approval prior to the issuance of a grading permit.

5. A sight distance analysis for the project's driveway connection at Ohi'a Ku Street will be submitted to the department for review and approval.

environment planning

305 High Street, Suite 104 · Wailuku, Hawaii 96793 · ph: (808)244-2015 · fax: (808)244-8729 · planning@mhinconline.com

Thank you again for providing us with your comments. Please feel free to call me should you have any questions.

Very truly yours,

Glenn Tadaki, Planner

GT:yp
cc: Jan Yokota, University of Hawaii
Don Fujimoto, Kulamalu Science, LLC
dowling\astronmy\dpwem.deares

JUN 2 1 2004

DEPARTMENT OF WATER SUPPLY
COUNTY OF MAUI
200 South High Street
WAILUKU, MAUI, HAWAII 96793
Telephone (808) 270-7816 • Fax (808) 270-7833

June 15, 2004

Munekiyo & Hiraga, Inc.
305 High, Suite 104
Wailuku, Hawaii 96793

SUBJECT: Proposed Advanced Technology Center and Advanced Technology Research Center – Draft Environmental Assessment, TMK: (2)2-3-08:038 & 039

Dear Mr. Munekiyo:

Thank you for the opportunity to review this project proposal.

According to the agreement entered into by Kulamalu Inc. and the Board of Water Supply, whenever Kulamalu desires to use any credits or allocate credits specifically to a portion of, or development within a property, Kulamalu will notify the Board by means of a signed statement in substantially the form attached as Schedule G.

In Appendix B of the project document, preliminary water demand calculations indicate an average daily demand of 17,070 gallons. On March 12, 2004, the applicant met with DWS staff to discuss source allocation for the commercial projects in the development area. The source allocation requested for this project was 12,558 gallons based on average daily demand. We ask that Notice of Exercise of Credits for the correct amount be submitted to DWS by the applicant for this project.

In the event that credits are inadequate or has been exhausted, DWS will not be able to approve Building Permit application for this project. The applicant will need to request placement of the property on the Upcountry meter priority list and wait for meters. If storage is inadequate, the applicant has to pay the storage portion of the Water System Development Fee. Similarly, if transmission is inadequate, the applicant has to pay the transmission portion of the Water System Development Fee for transmission improvements.

We encourage the applicant to integrate water conservation measures as well as adopt Best Management Practices (BMPs) in the project design and construction This information was provided to the applicant during the early consultation process for an EA for this project.

Should you have any questions, please contact our Water Resources and Planning Division at 270-7199.

Sincerely,

George Y. Tengan
Director

eam

MUNEKIYO & HIRAGA, INC.

June 22, 2004

George Y. Tengan, Director
Department of Water Supply
200 South High Street
Wailuku, Hawaii 96793

SUBJECT: Proposed Advanced Technology Center and Advanced Technology Research Center; TMK 2-3-08:38 and 39(por.)

Dear Mr. Tengan:

Thank you for your June 15, 2004 letter commenting on the subject's Draft Environmental Assessment (EA). On behalf of the applicant, the University of Hawaii, Institute for Astronomy, we would like to note the following.

1. Kulamalu Inc. will notify the Board of Water Supply, in writing, of its intent to allocate source credits for the proposed project.

2. As there are sufficient source credits available, the Notice of Exercise of Credits for the requested source allocation of 12,558 gallons per day will be submitted to the department.

3. Appropriate water conservation measures will be employed for the project. Examples of such measures include, but are not limited to, the use of low-flow plumbing fixtures, maintenance of fixtures to prevent leaks, use of rain sensors on automated irrigation controllers, elimination of single-pass cooling systems, and the use of climate-adapted plants. Best Management Practices (BMPs) will be implemented during construction to minimize infiltration and runoff from construction-related activities. The BMPs will be prepared in accordance with County standards and will be included in the civil drawings and grading permit application submittals for the project.

environment
planning

305 High Street, Suite 104 · Wailuku, Hawaii 96793 · ph: (808)244-2015 · fax: (808)244-8729 · planning@mhinconline.com

Thank you again for providing us with your comments. Please feel free to call me should you have any questions.

Very truly yours,

Glenn Tadaki, Planner

GT:lfm
dowling\astronmy\dws.deores

SUMMARY OF MEETING
WITH KULA COMMUNITY ASSOCIATION'S
BOARD OF DIRECTORS

On May 11, 2004, the applicant met with the Kula Community Association's (KCA) board of directors to provide them with a current overview of the proposed project. In addition to questions about the function of the proposed IFA facility, discussions that surfaced at this meeting encompassed planned land uses and improvements within the Kulamalu Town Center Subdivision; disposition of the IFA's existing Waiakoa facility; project lighting; colors, signage, and landscaping; and views from Kula Highway.

The applicant noted that a parking area, a skilled nursing facility, and a keiki zoo are land uses that are presently planned within the subdivision. Curbs, gutters, and sidewalks, as well as benches, tree wells, and bike racks will be installed within the subdivision. Lighting from the project's buildings and parking lot will be appropriately shielded and downward directed to minimize impacts to surrounding and downslope properties. The color palette for the project will utilize neutral, complementary colors that are compatible with its rural environs. The IFA's existing Waiakoa facility will continue to be used but its primary function will be for equipment storage and vehicle maintenance purposes. To the extent possible, drought-tolerant plants will be utilized for project landscaping. Signage for the project will be low-key and nondescript in keeping with its rural setting. Due to its downslope location, the new IFA facility will not be on the same horizontal view plane as Kula Highway. In summary, the KCA was pleased with the applicant's plans for the proposed IFA facility.
dowling\astronmy\051104.mtgsummary

References

References

County of Maui, Office of Economic Development, Maui County Data Book 2001, June 2001.

Department of Geography, University of Hawaii, Atlas of Hawaii, Third Edition, University of Hawaii Press, 1998.

Federal Emergency Management Agency, Flood Insurance Rate Map Community-Panel Number 150003/0260B, June 1, 1981.

Munekiyo & Arakawa, Inc., Final Environmental Assessment - Kulamalu Project, July 1997.

Munekiyo, Arakawa & Hiraga, Inc., Final Environmental Assessment - Kulamalu Water Tank and Associated Waterline and Appurtenant Improvements, March 1999.

University of Hawaii, Land Study Bureau, Detailed Land Classification - Island of Maui, L.S.B. Bulletin No. 7, May 1967.

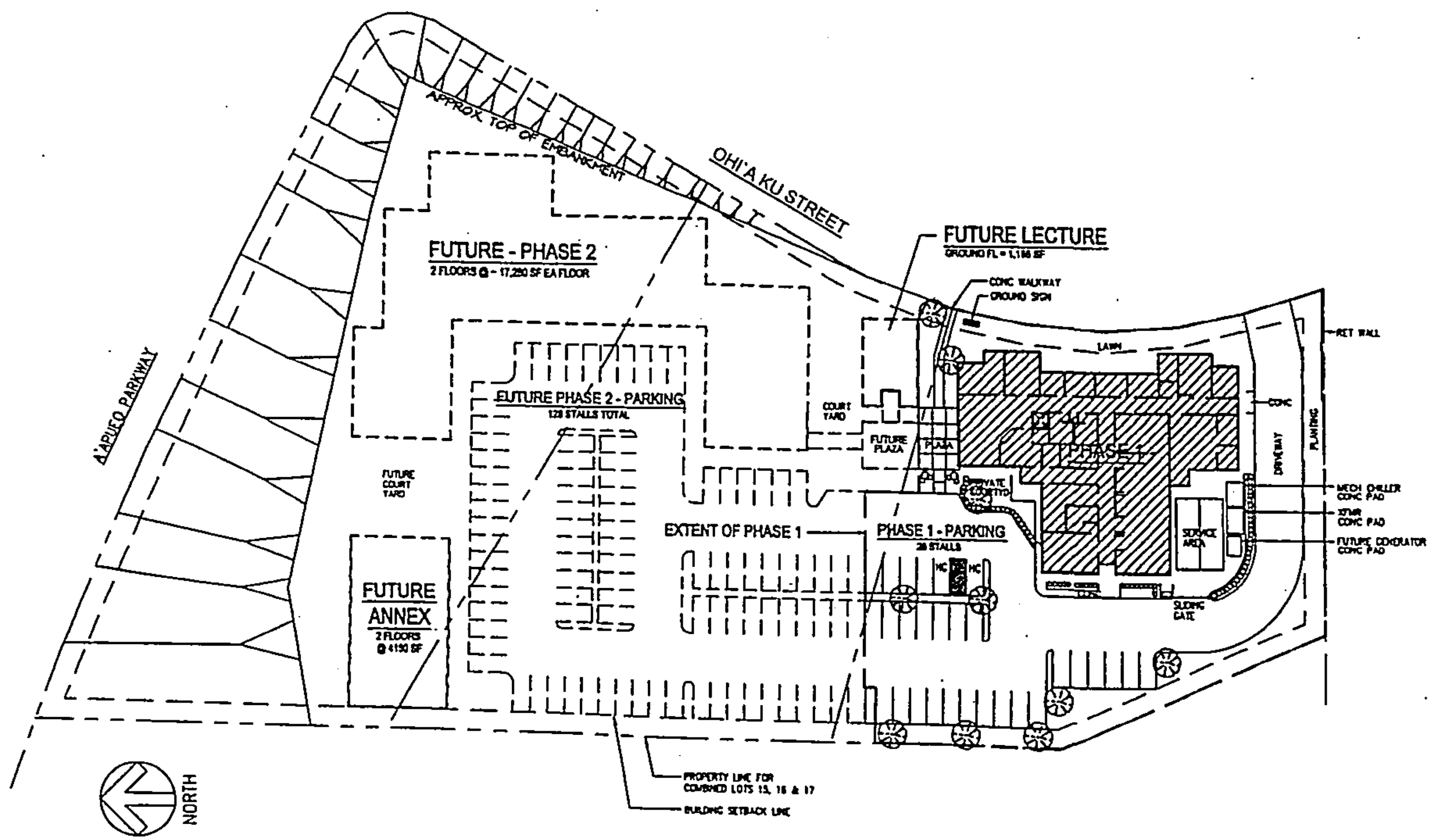
U.S. Soil Conservation Service, Soil Survey of Islands of Kauai, Oahu, Maui, Molokai, and Lanai, State of Hawaii, U.S. Government Printing Office, 1972.

SMS, Maui County Community Plan Update Program: Socio-Economic Forecast-Phase I Report, Final Version (June 14, 2002).

Appendices

Appendix A

Preliminary Development Plans

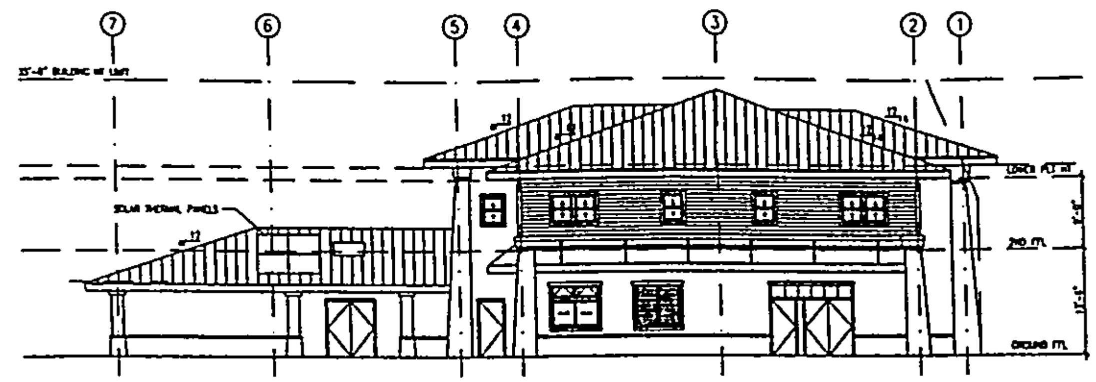


INSTITUTE FOR ASTRONOMY - PHASE 1

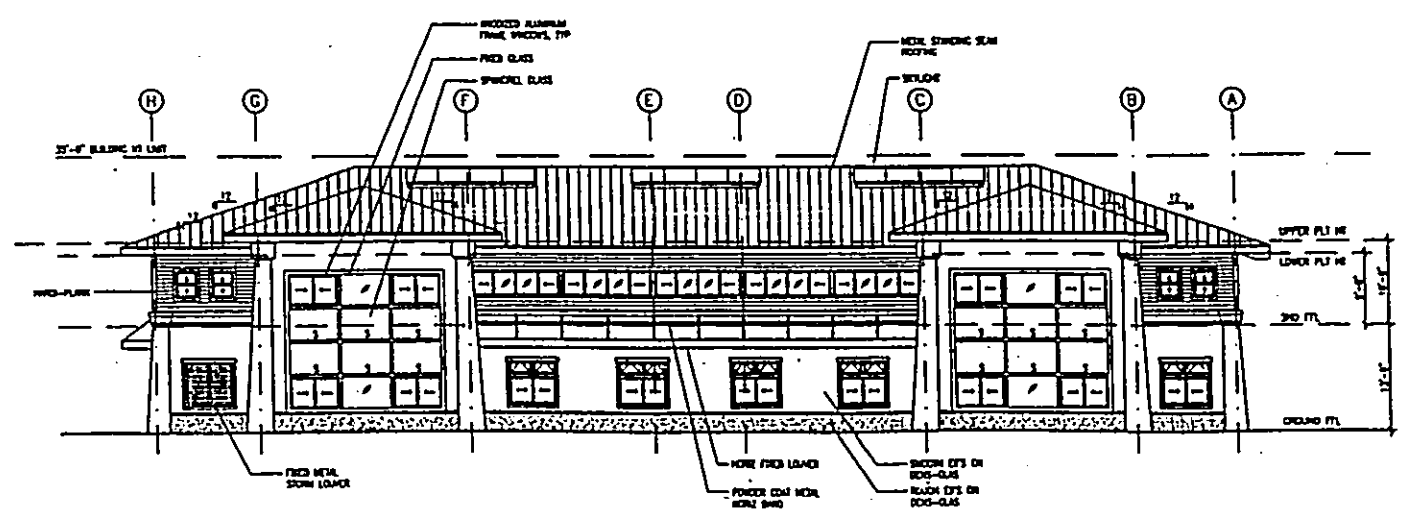
SITE PLAN

SCALE: 1" = 50'-0"

KOBER / HANSSEN / MITCHELL ARCHITECTS



South Elevation



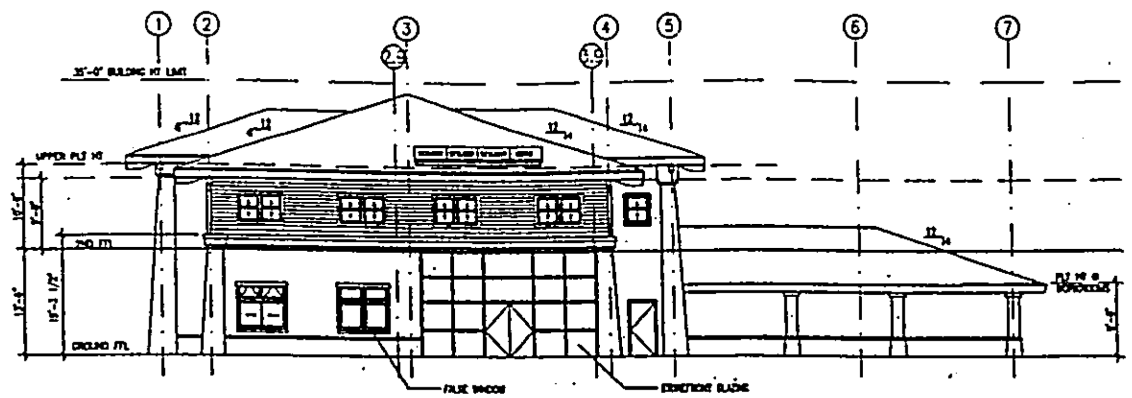
Mauka Elevation

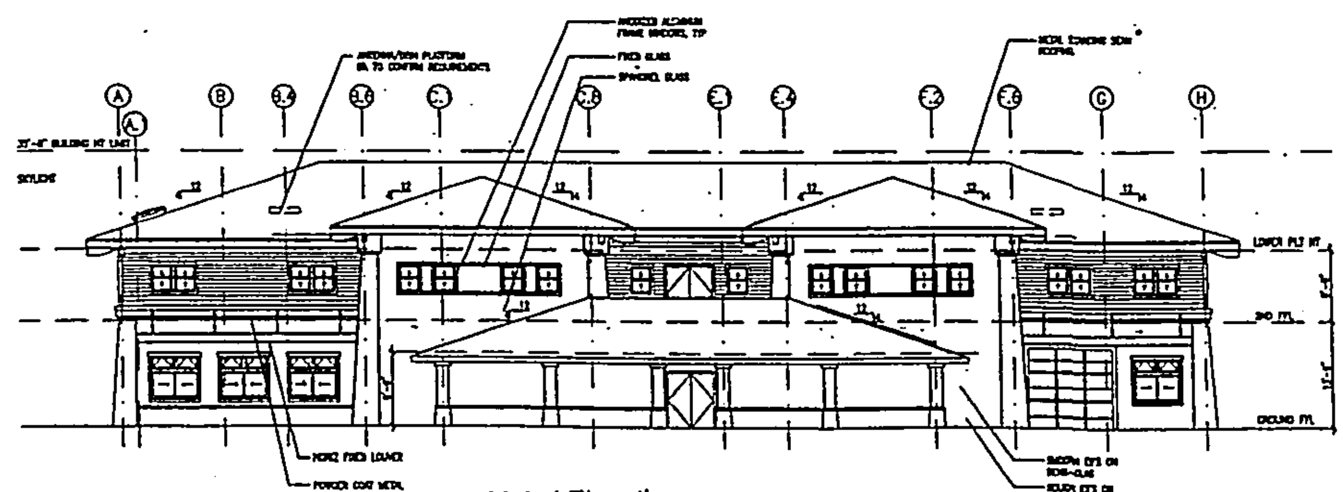
INSTITUTE FOR ASTRONOMY - PHASE 1

EXTERIOR ELEVATIONS

KOBER / HANSSEN / MITCHELL ARCHITECTS

SCALE: 1/16" = 1'-0"


North Elevation

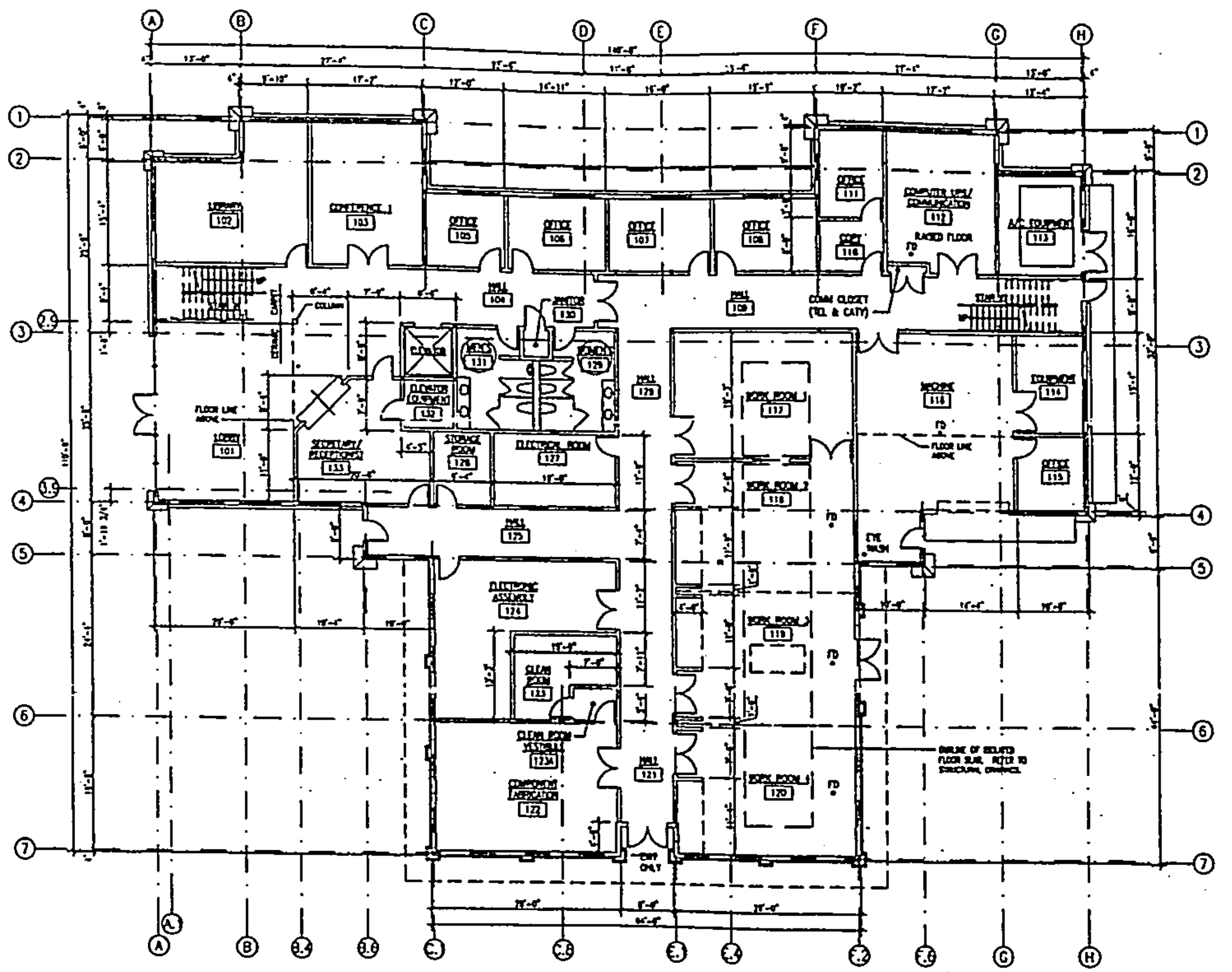

Makai Elevation

NSTITUTE FOR ASTRONOMY - PHASE 1

EXTERIOR ELEVATIONS

KOBER / HANSSEN / MITCHELL ARCHITECTS

SCALE: 1/16" = 1'-0"



INSTITUTE FOR ASTRONOMY - PHASE 1

GROUND FLOOR PLAN

SCALE: 1/16" = 1'-0"

KOBER / HANSSEN / MITCHELL ARCHITECTS

ROOM FINISH SCHEDULE

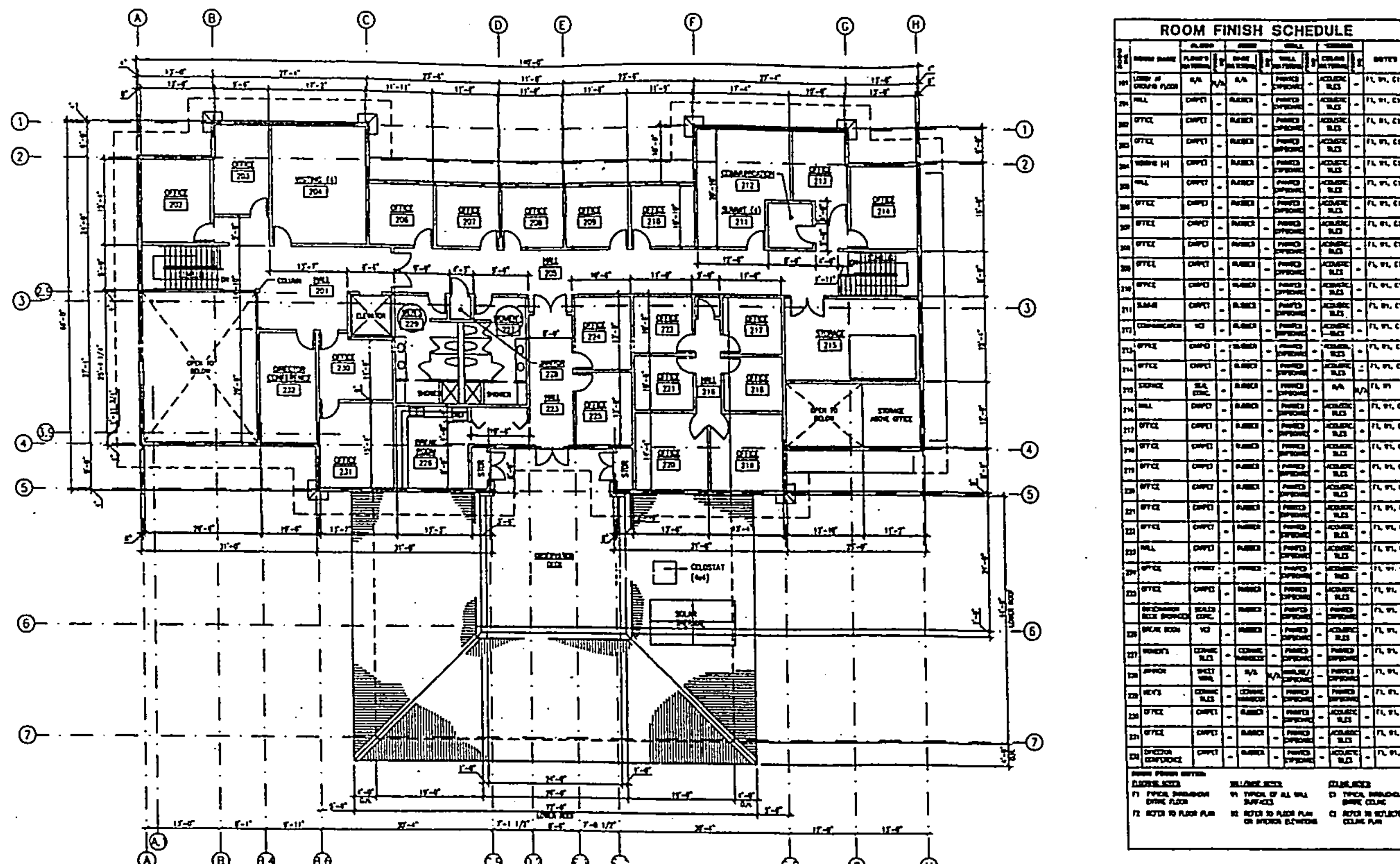
ROOM NO.	ROOM NAME	FLOOR: FLOOR MATERIAL	NOTE	BASE: BASE MATERIAL	NOTE	WALL: WALL MATERIAL	NOTE	CEILING: CEILING MATERIAL	NOTE	NOTES
101	LOBBY	TILE & CARPET	-	RUBBER	-	PAINTED GYPBOARD	-	ACOUSTIC TILE	-	F1, W1, C1
102	LIBRARY	CARPET	-	RUBBER	-	PAINTED GYPBOARD	-	ACOUSTIC TILE	-	F1, W1, C1
103	CONFERENCE 1	CARPET	-	RUBBER	-	PAINTED GYPBOARD	-	ACOUSTIC TILE	-	F1, W1, C1
104	HALL	CARPET	-	RUBBER	-	PAINTED GYPBOARD	-	ACOUSTIC TILE	-	F1, W1, C1
105	OFFICE	CARPET	-	RUBBER	-	PAINTED GYPBOARD	-	ACOUSTIC TILE	-	F1, W1, C1
106	OFFICE	CARPET	-	RUBBER	-	PAINTED GYPBOARD	-	ACOUSTIC TILE	-	F1, W1, C1
107	OFFICE	CARPET	-	RUBBER	-	PAINTED GYPBOARD	-	ACOUSTIC TILE	-	F1, W1, C1
108	OFFICE	CARPET	-	RUBBER	-	PAINTED GYPBOARD	-	ACOUSTIC TILE	-	F1, W1, C1
109	HALL	CARPET	-	RUBBER	-	PAINTED GYPBOARD	-	ACOUSTIC TILE	-	F1, W1, C1
110	COPY	CARPET	-	RUBBER	-	PAINTED GYPBOARD	-	ACOUSTIC TILE	-	F1, W1, C1
111	OFFICE	CARPET	-	RUBBER	-	PAINTED GYPBOARD	-	ACOUSTIC TILE	-	F1, W1, C1
112	COMPUTER UPS/ COMMUNICATION	CARPET	-	RUBBER	-	PAINTED GYPBOARD	-	ACOUSTIC TILE	-	F1, W1, C1
	COMMUNICATION CLOSET	SEALED CONC.	-	RUBBER	-	PAINTED GYPBOARD	-	N/A	N/A	F1, W1
113	A/C EQUIPMENT	SEALED CONC.	-	RUBBER	-	PAINTED GYPBOARD	-	N/A	N/A	F1, W1
114	EQUIPMENT	[illegible]	-	RUBBER	-	PAINTED GYPBOARD	-	[illegible]	-	F1, W1, C1
115	OFFICE	CARPET	-	RUBBER	-	PAINTED GYPBOARD	-	ACOUSTIC TILE	-	F1, W1, C1
116	MACHINE	[illegible]	-	RUBBER	-	PAINTED GYPBOARD	-	[illegible]	-	F1, W1, C1
117	WORK ROOM 1	[illegible]	-	RUBBER	-	PAINTED GYPBOARD	-	[illegible]	-	F1, W1, C1
118	WORK ROOM 2	[illegible]	-	RUBBER	-	PAINTED GYPBOARD	-	[illegible]	-	F1, W1, C1
119	WORK ROOM 3	[illegible]	-	RUBBER	-	PAINTED GYPBOARD	-	[illegible]	-	F1, W1, C1
120	WORK ROOM 4	[illegible]	-	RUBBER	-	PAINTED GYPBOARD	-	[illegible]	-	F1, W1, C1
121	HALL	CARPET	-	RUBBER	-	PAINTED GYPBOARD	-	ACOUSTIC TILE	-	F1, W1, C1
122	COMPONENT FABRICATION	VCT	-	RUBBER	-	PAINTED GYPBOARD	-	ACOUSTIC TILE	-	F1, W1, C1
123	CLEAN ROOM	VCT	-	RUBBER	-	PAINTED GYPBOARD	-	ACOUSTIC TILE	-	F1, W1, C1
123A	CLEAN ROOM VESTIBULE	VCT	-	RUBBER	-	PAINTED GYPBOARD	-	ACOUSTIC TILE	-	F1, W1, C1
124	ELECTRONIC ASSEMBLY	VCT	-	RUBBER	-	PAINTED GYPBOARD	-	ACOUSTIC TILE	-	F1, W1, C1
125	HALL	CARPET	-	RUBBER	-	PAINTED GYPBOARD	-	ACOUSTIC TILE	-	F1, W1, C1
126	STORAGE ROOM	VCT	-	RUBBER	-	PAINTED GYPBOARD	-	ACOUSTIC TILE	-	F1, W1, C1
127	ELECTRICAL ROOM	SEALED CONC.	-	RUBBER	-	PAINTED GYPBOARD	-	N/A	N/A	F1, W1
128	HALL	CARPET	-	RUBBER	-	PAINTED GYPBOARD	-	ACOUSTIC TILE	-	F1, W1, C1
129	WOMEN'S	CERAMIC TILE	-	CERAMIC [illegible]	-	PAINTED GYPBOARD	-	PAINTED GYPBOARD	-	F1, W1, C1
130	JANITOR	SHEET VINYL	-	N/A	N/A	[illegible]	-	PAINTED GYPBOARD	-	F1, W1, C1
131	MEN'S	CERAMIC TILE	-	CERAMIC [illegible]	-	PAINTED GYPBOARD	-	PAINTED GYPBOARD	-	F1, W1, C1
132	ELEVATOR EQUIPMENT	SEALED CONC.	-	RUBBER	-	PAINTED GYPBOARD	-	N/A	N/A	F1, W1
133	SECRETARY / RECEPTION	CARPET	-	RUBBER	-	PAINTED GYPBOARD	-	ACOUSTIC TILE	-	F1, W1, C1

ROOM FINISH NOTES:

FLOORING NOTES:
F1 TYPICAL THROUGHOUT ENTIRE FLOOR
F2 REFER TO FLOOR PLAN

WALL/BASE NOTES:
W1 TYPICAL AT ALL WALL SURFACES
W2 REFER TO FLOOR PLAN OR INTERIOR ELEVATIONS

CEILING NOTES:
C1 TYPICAL THROUGHOUT ENTIRE CEILING
C2 REFER TO REFLECTED CEILING PLAN



INSTITUTE FOR ASTRONOMY - PHASE 1

SECOND FLOOR PLAN

SCALE: 1/16" = 1'-0"

KOBER / HANSSEN / MITCHELL ARCHITECTS

Appendix B

Preliminary Engineering Report

PRELIMINARY ENGINEERING REPORT

FOR

INSTITUTE FOR ASTRONOMY

ADVANCED TECHNOLOGY CENTER (PHASE 1)

AND

ADVANCED TECHNOLOGY AND RESEARCH CENTER (PHASE 2)

Koholla, Kula, Maui, Hawaii
TMK: (2) 2-3-08: 38 and Por. 39

Developer: Kulamalu Science LLC

Rev. January 2004
Rev. March 2003
October 2002

Austin, Tsutsumi & Associates, Inc.
Civil Engineers • Surveyors
1871 Wili Pa Loop, Suite A

Wailuku, Maui, Hawaii 96793

TABLE OF CONTENTS

PRELIMINARY ENGINEERING REPORT
FOR
INSTITUTE FOR ASTRONOMY
ADVANCED TECHNOLOGY CENTER (PHASE 1)
AND
ADVANCED TECHNOLOGY AND RESEARCH CENTER (PHASE 2)

I. INTRODUCTION

The purpose of this report is to provide an overview of the engineering design for the Institute for Astronomy-Phases 1 and 2 project in Kula, Maui. This report evaluates the existing site conditions and defines requirements for grading, drainage, sewer, and water utilities, along with other miscellaneous site improvements.

II. PROPOSED PROJECT

A. Location

The proposed project is located within Lots 15, 16, and 17 of the Kulamalu Commercial Subdivision within Tax Map Key (2) 2-3-08: 38 and Portion of 39. Phase 1 is situated on Lot 15 and a portion of Lot 16. Phase 2 (future) is situated on Lot 17 and the remaining portion of Lot 16. The project site is bounded by A'Apueo Parkway to the north, Ohi'a Ku Street to the east, Lot 18 (a proposed 12 lot residential lot subdivision to the west. The current landowner is Kulamalu Science LLC. Refer to Exhibit 1 for location and Vicinity Map.

B. Project Description

The proposed project consists of two phases. Phase 1 consists of a 15,865 square foot (two story) main building, 28 parking stalls, landscaping and related site work. The building in Phase 1 shall consist of offices, an observation deck, laboratory facilities, etc. Phase 2, which is a future phase, will consist of a 34,560 square foot (two story) building, an 1,168 square foot lecture building, an 8,300 square foot annex, and approximately 100 additional parking stalls. The total project area is approximately 3.4 acres. Access to the proposed project site from Kula Highway will be provided through A'Apueo Parkway and Ohi'a Ku Street. Refer to Exhibit 2 for Preliminary Site Plan.

On-site improvements include clearing and grubbing of the site, excavation and embankment for construction of the parking area and a building pad, construction and installation of water, sewer, and drainage utilities. Off-site improvements include water, sewer and electrical connections from Ohi'a Ku Street. All infrastructure work will conform to the "Standard Specifications" and "Standard Details" of the Department of Public Works, County of Maui.

III. EXISTING CONDITIONS

A. Topography and Soil Conditions

The site is currently covered with grass and hydromulch from the recent construction activity for the Kulamalu Town Cneter Subdivision (also known as the Kulamalu Commercial Subdivision. Elevations on the project site range between 1774 feet mean sea level (msl) and 1752 feet msl. Slopes within the project site are approximately 3 percent.

There are two different soil classifications on the project site: Keahua Cobbly Silty Clay, 7 to 15 percent slopes (KnhC) and Keahua Cobbly Silty Clay Loam, 15 to 25 percent slopes (KnaD). The Keahua series consists of well-drained soils found on the upland areas of Maui. Runoff is slow to moderate and the erosion hazard varies from slight to moderate.

Soil classifications and descriptions are based on the United States Department of Agriculture (USDA) Soil Conservation Service's (SCS) publication, "Soil Survey of the Islands of Kauai, Oahu, Maui, Molokai, and Lanai, State of Hawaii, dated August 1972.

B. Infrastructure

1. Water

Existing 12" ductile iron county waterlines are located within A'Apueo Parkway and Ohi'a Ku Street. There are existing fire hydrants surrounding the project site. Water service (3/4-inch laterals) are available for each of the lots.

2. Sewer

The site currently generates no wastewater flow. An existing sewer system is located within Ohi'a Ku Street and A'Apueo Parkway. Sewer service laterals are available for each of the lots.

3. Drainage

Onsite storm water runoff within the project site generally sheet flows in a northwesterly direction towards Lot 17. It eventually flows towards an existing underground drainage system within A'Apueo Parkway. There is an existing underground drainage system within Ohi'a Ku Street.

Existing on-site runoff is estimated at approximately 1.32 cubic feet per second (cfs) and 3.16 cfs for Phases 1 and 2, respectively. It is based on a 50 Yr – 1 Hr storm recurrence interval. Refer to Appendix A for Preliminary Hydrology Computations.

4. Roadway

The proposed project is situated along the 60' wide (right-of-way) Ohi'a Street. The typical roadway section for Ohi'a Street consists of a 40' wide pavement, curb to curb.

C. Flood Zone

The project site sits in a designated Flood Zone "C". Flood Zone "C" is described as an area of minimal flooding. Flood zone information is obtained from the Federal Emergency Management Agency, Flood Insurance Rate Map (FIRM), Panel No. 150003-0260B, dated June 1, 1981. Refer to Exhibit 5 for the Flood Zone Map.

IV. PROPOSED INFRASTRUCTURE IMPROVEMENTS

A. Grading and Drainage Plan

The project will require excavation and embankment for the proposed buildings and parking lot in Phase 1. The site will be graded to maintain the existing northwesterly drainage pattern and for the future buildings and parking lot for Phase 2. An off-site retention basin has been designed to accommodate post development flow. The on-site drainage system improvements will consist of installation of grated drain inlets, manholes and under ground drainlines.

Post development flow from the project site is calculated at approximately 4.46 cfs and 7.25 cfs for Phases 1 and 2, respectively. Hydrology calculation is based on a 50 Yr – 1 Hr storm recurrence interval. Refer to Appendix A for Preliminary Hydrology Computations. The proposed drainage system for the project site will be designed to maintain the predevelopment discharge rate and prevent adverse effect to the downstream properties. Refer to Exhibit 4 for Preliminary Grading and Drainage Plan.

B. Water

Water service is available to the project site. Preliminary water demand estimates require an average daily demand of approximately 2,220 gallons per day (gpd) and 6,200 gpd for Phases 1 and 2, respectively. Refer to Appendix B for Preliminary Water Demand Computations.

C. Sewer

A new sewer system will be installed within the project site to provide sewer service to the buildings. Preliminary wastewater contributions are calculated at approximately 2,000 gpd (average daily demand) and 5,500 gpd for Phases 1 and 2, respectively. Refer to Appendix C for Preliminary Wastewater Computations.

V. CONCLUSION

The proposed improvements for this project will be designed to produce no adverse effects to existing facilities and to the surrounding environment. All improvements will be designed in accordance with the rules and regulations of all applicable agencies.

EXISTING ON-SITE HYDROLOGY CALCULATIONS
(50 Year – 1 Hour Storm)

ADVANCE TECHNOLOGY CENTER (PHASE 1)

Project Site Description:

Runoff Coefficient (c)

Site description: Grassed and hydromulched, unimproved

c = 0.30

Area (a)

a = 0.977 acres

Rainfall Intensity (I)

Recurrence Interval:	50 Yr – 1 Hr = 3.0 inches
Average site slope:	3.0 %
Longest reach length:	approximately 230 feet
Time of concentration:	16.0 minutes

I = 4.5 inches / hour

Runoff (Q)

Q = c x i x a

Q = discharge, in cubic feet per second (cfs)
c = runoff coefficient
i = rainfall intensity, inches per hour
a = watershed area, in acres

Q_{50} = (0.30)(0.977 acres)(4.5 inches / hour)

= 1.32 cfs

ADVANCE RESEARCH TECHNOLOGY CENTER (PHASE 2)

Project Site Description:

Runoff Coefficient (c)

Site description: Grassed and hydromulched, unimproved

c = 0.30

Area (a)

a = 2.45 acres

Rainfall Intensity (i)

Recurrence Interval: 50 Yr – 1 Hr = 3.0 inches

Average site slope: 9.6 %

Longest reach length: approximately 500 feet

Time of concentration: 18.0 minutes

i = 4.3 inches / hour

Runoff (Q)

Q = c x i x a

Q = discharge, in cubic feet per second (cfs)
c = runoff coefficient
i = rainfall intensity, inches per hour
a = watershed area, in acres

Q_{50} = (0.30)(2.45 acres)(4.3 inches / hour)

= 3.16 cfs

POST DEVELOPMENT ON-SITE HYDROLOGY CALCULATIONS

ADVANCE TECHNOLOGY CENTER (PHASE 1)

Project Site Description:

Area (a)

Total Project Site: 0.977 acres

Area Breakdown
- Buildings: 0.317 acres
- 29 Stall Parking Areas: 0.410 acres
- Landscape Areas: 0.253 acres

Runoff Coefficient (c)

Grassed areas: c = 0.22
Parking areas: c = 0.95

$$c = \frac{0.95(0.317+0.410)+0.22(0.253)}{0.977} = 0.76$$

Rainfall Intensity (i)

Recurrence Interval: 50 Yr – 1 Hr = 3.0 inches

Average site slope: 3.0 %

Longest reach length: approximately 405 feet

Time of concentration: 6.0 minutes

i = 6.0 inches / hour

Runoff (Q)

Q = c x i x a

Q = discharge, in cubic feet per second (cfs)
c = runoff coefficient

i = rainfall intensity, inches per hour
a = watershed area, in acres

Q_{50} = (0.76)(0.977 acres)(6.0 inches / hour)

= 4.46 cfs

ADVANCE RESEARCH TECHNOLOGY CENTER (PHASE 2)

Project Site Description:

Area (a)

Total Project Site:	2.45 acres
Area Breakdown:	
Buildings:	0.539 acres
99 Stall Parking Areas:	0.672 acres
Landscape Areas:	1.240 acres

Runoff Coefficient (c)

Grassed areas: c = 0.22
Parking areas: c = 0.95

$$c = \frac{(0.95(0.539+0.672)+0.22(1.24))}{2.45} = 0.58$$

Rainfall Intensity (i)

Recurrence Interval: 50 Yr – 1 Hr = 3.0 inches

Average site slope: 9.6 %

Longest reach length: approximately 500 feet

Time of concentration: 11.0 minutes

i = 5.1 inches / hour

Runoff (Q)

Q = c x i x a

Q = discharge, in cubic feet per second (cfs)
c = runoff coefficient
i = rainfall intensity, inches per hour
a = watershed area, in acres

Q_{50} = (0.58)(2.45 acres)(5.1 inches / hour)

= 7.25 cfs

PRELIMINARY WATER DEMAND CALCULATIONS

ADVANCE TECHNOLOGY CENTER (PHASE 1)

Project Site Description:

Total Project Area = 0.977 acres

Area (a)

Main Building (Two Story, Total Area=15,561 square feet)
Landscape Area =11,023 s.f.

Average Daily Water Demand Requirements

Commercial/Industrial Mix 140 gallons / 1,000 square feet (Table 100-18, Water System Standards)

Landscape 1.5 inches / week or .134 gallons/s.f./day (Estimated)

Water Demand Calculation

Average Daily Demand

15,561 s.f. (140 gal./1,000 s.f.) + 11,023 s.f. (.134 gal./ps.f.) = 2,179+ 1,477

= 3,656 gallons per day (gpd), Average Daily Demand
Say, 3,660 pgpd

Maximum Daily Demand

Avg. Daily Demand x 1.5 = Maximum Daily Demand

= 3,660 gpd x 1.5

= 5,490 gpd, Maximum Daily Demand

ADVANCE RESEARCH TECHNOLOGY CENTER (PHASE 2)

Project Site Description:

Total Project Area = 2.45 acres

Area (a)

Lecture Building (One Story, Total Area=1,168 s.f.)
Future Building (Two Story, Total Area= 34,560 square feet)
Future Annex (Two Story, Total Area= 8,300 s.f.)
Landscape Area 54,107 s.f.

Average Daily Water Demand Requirements

Commercial/Industrial Mix 140 gallons / 1,000 square feet (Table 100-18, Water System Standards)

Landscape .134 gallons / square feet (Estimated)

Water Demand Calculation

Average Daily Demand

44,028 s.f. (140 gal./1,000 s.f.) + 54,107 s.f. (.134 gal./s.f.) = 6,164 + 7250

= 13,414 gallons per day (gpd), Average Daily Demand
Say, 13,410 gpd

Maximum Daily Demand

Avg. Daily Demand x 1.5 = Maximum Daily Demand

= 13,410 gpd x 1.5

= 20,115gpd, Maximum Daily Demand

Reference: Water System Standards
Depertement of Water Supply, County of Maui, 2002 and as amended

PRELIMINARY WASTEWATER CONTRIBUTION CALCULATIONS

Advance Technology Center (Phase 1)

Project Site Description:

Main Building (Two Story, Total Area=15,561 square feet)

Wastewater Contribution Standards:

Office Employees	1 per 200 s.f. of floor area @ 30 gallons / unit / day

Wastewater Contribution Calculations:

15,561 s.f. (1 employee/200 s.f. of floor area) x 30 gal. / unit / day

= 2,334 gpd, Average Daily Demand
Say 2,330 gpd

Advance Research Technology Center (Phase 2)

Project Site Description:

Lecture Building (One Story, Total Area=1,168 s.f.)
Future Building (Two Story, Total Area=34,560 square feet)
Future Annex (Two Story, Total Area=8,300 s.f.)

Wastewater Contribution Standards:

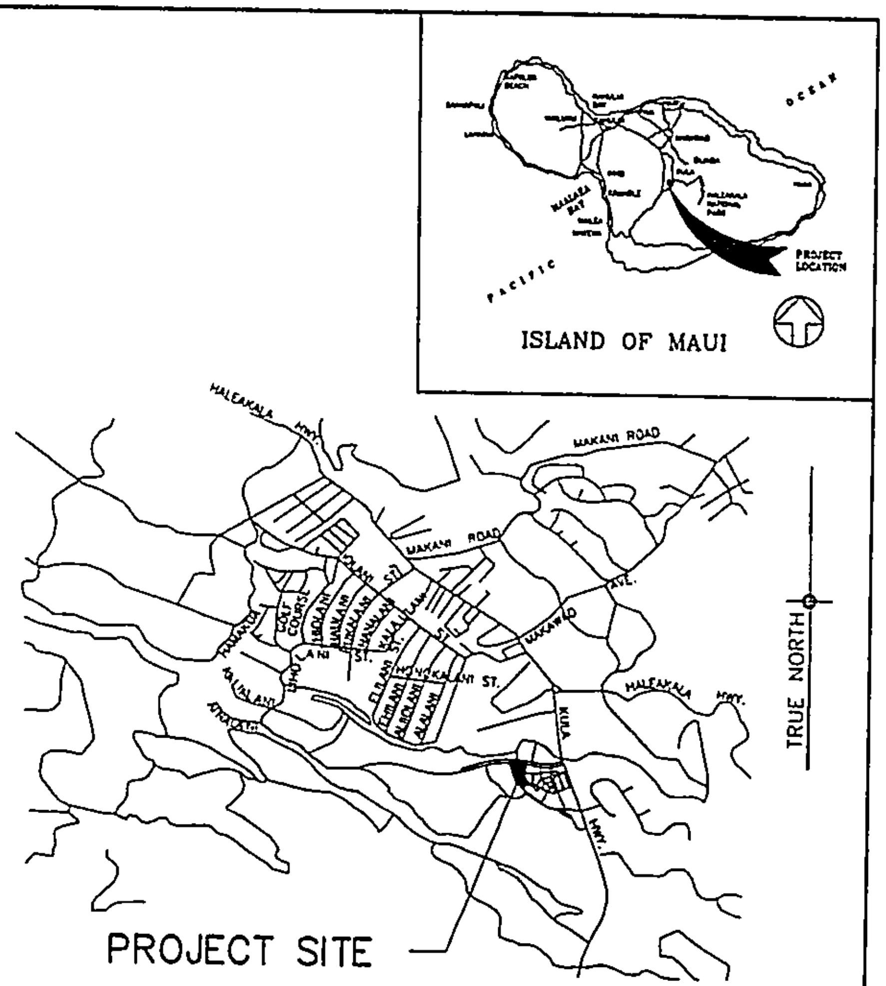
Office Employees	1 per 200 s.f. of floor area @ 30 gallons / unit / day

Wastewater Contribution Calculations:

44,028 s.f. (1 employee/200 s.f. of floor area) x 30 gal. / unit / day

= 6,604 gpd, Average Daily Demand
Say, 6,600 gpd

Reference: Wastewater Flow Standards
Wastewater Reclamation Division, County of Maui, 1993



VICINITY MAP

PRELIMINARY ENGINEERING REPORT INSTITUTE FOR ASTRONOMY PHASES 1 AND 2 KULA, MAUI, HAWAII	ATA LOCATION AND VICINITY MAP	EXHIBIT 1

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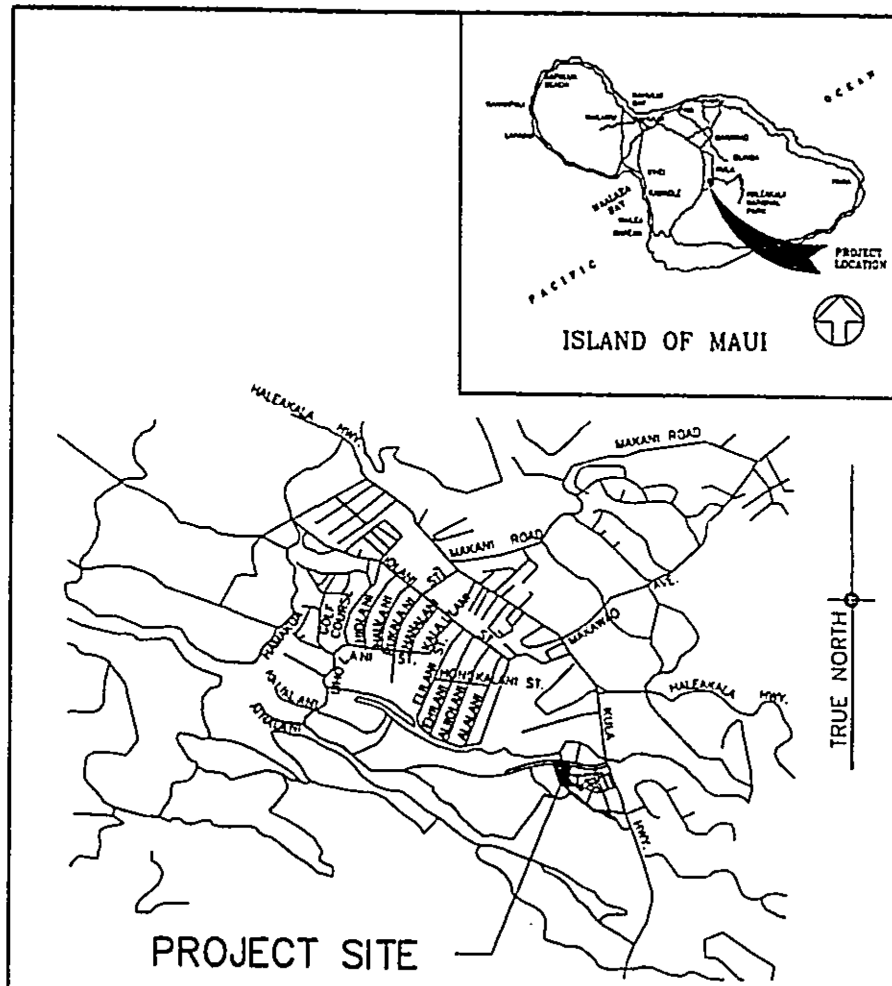

VICINITY MAP

PRELIMINARY ENGINEERING REPORT INSTITUTE FOR ASTRONOMY PHASES 1 AND 2 KULA, MAUI, HAWAII	ATA LOCATION AND VICINITY MAP	EXHIBIT 1

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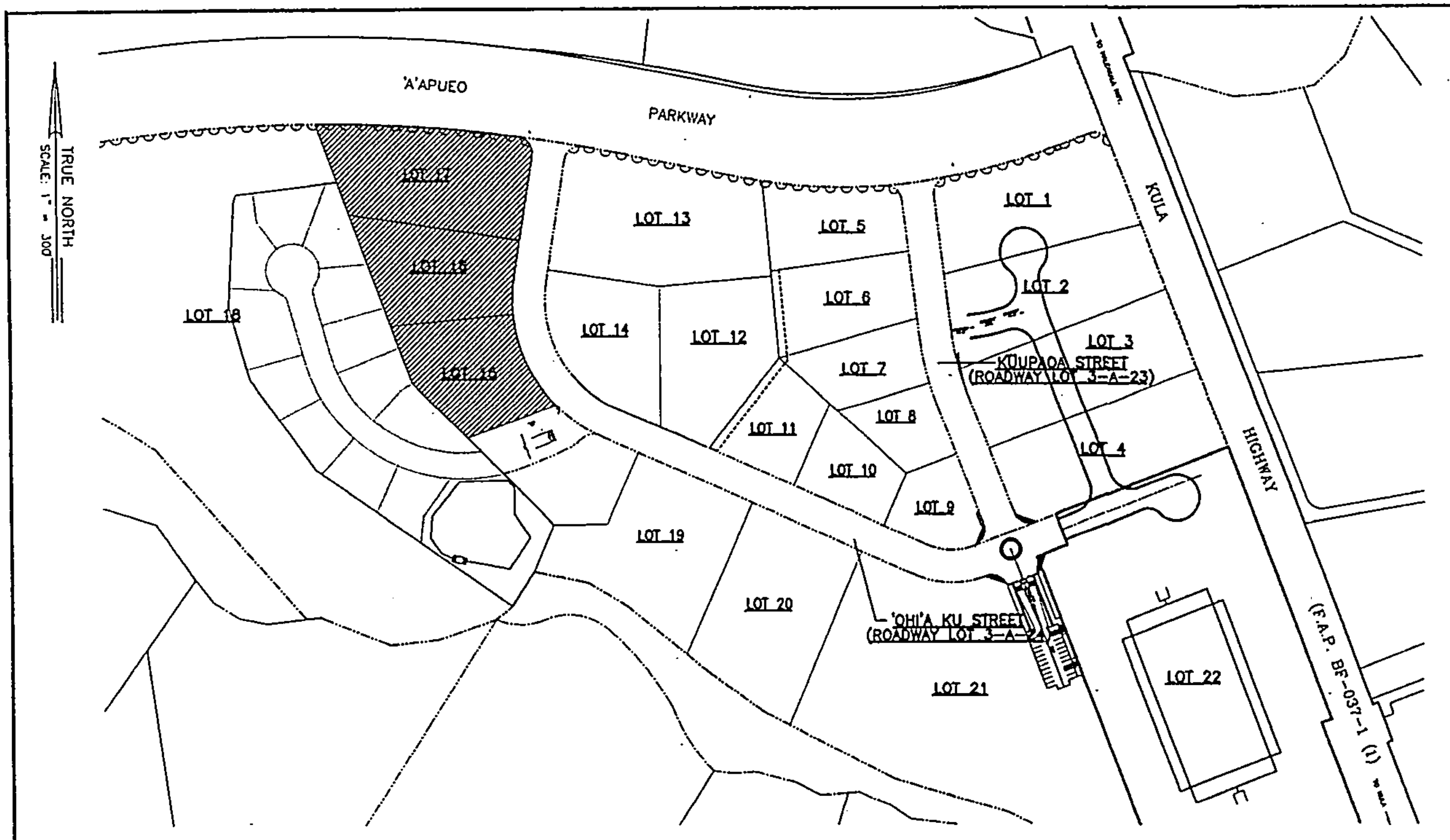

SITE PLAN
SCALE: 1" = 300'-0"

PRELIMINARY ENGINEERING REPORT INSTITUTE FOR ASTRONOMY PHASES 1 AND 2 KULA, MAUI, HAWAII	ATA AUSTIN, TSUTSUMI & ASSOCIATES, INC. SITE PLAN	EXHIBIT 2

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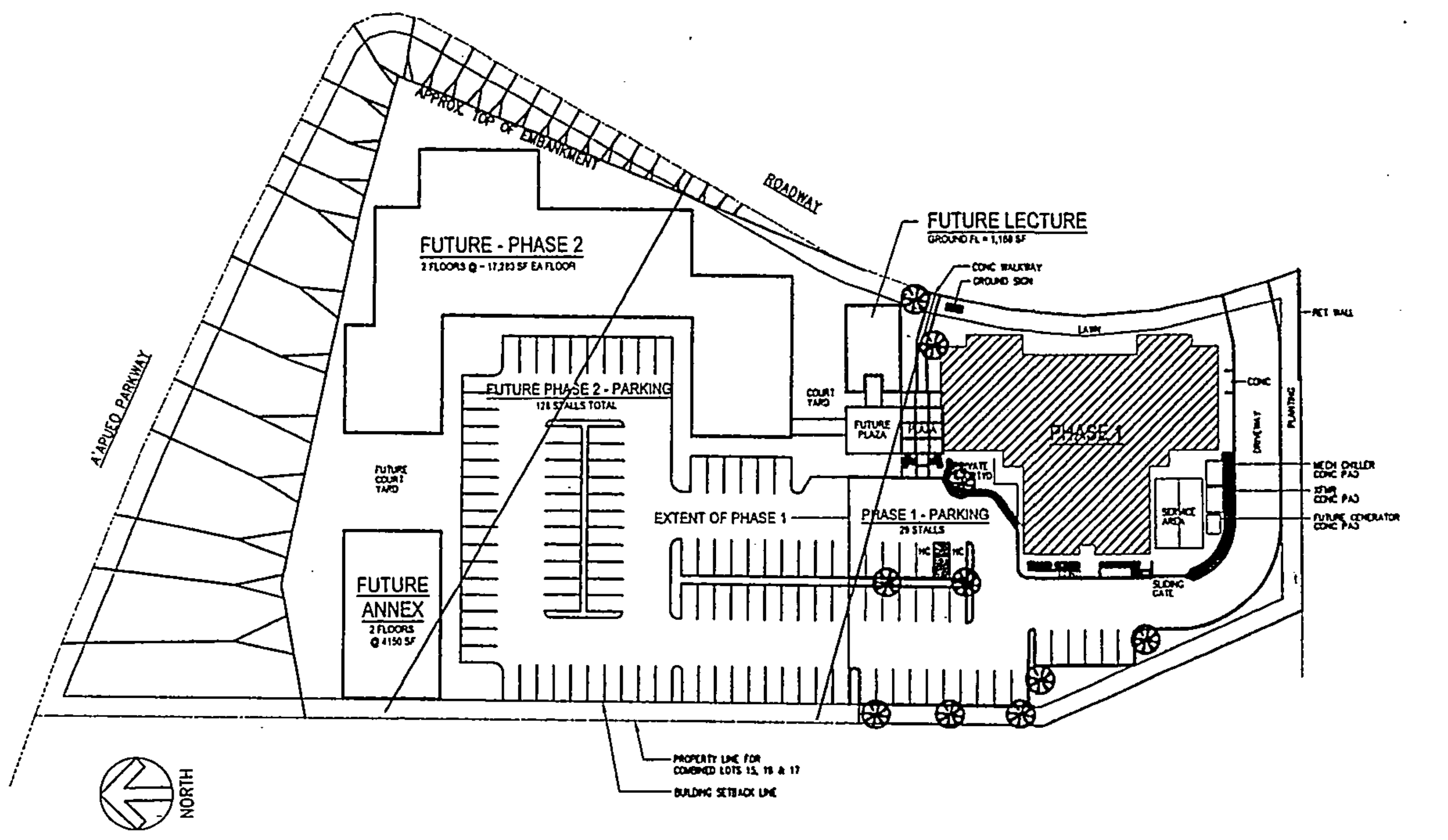

GENERAL LAYOUT PLAN

SCALE: 1" = 50'-0"

GRADING AND DRAINAGE REPORT INSTITUTE FOR ASTRONOMY KULA, MAUI, HAWAII	ATA AUSTIN, TSUTSUMI & ASSOCIATES, INC. GENERAL LAYOUT PLAN	EXHIBIT 3

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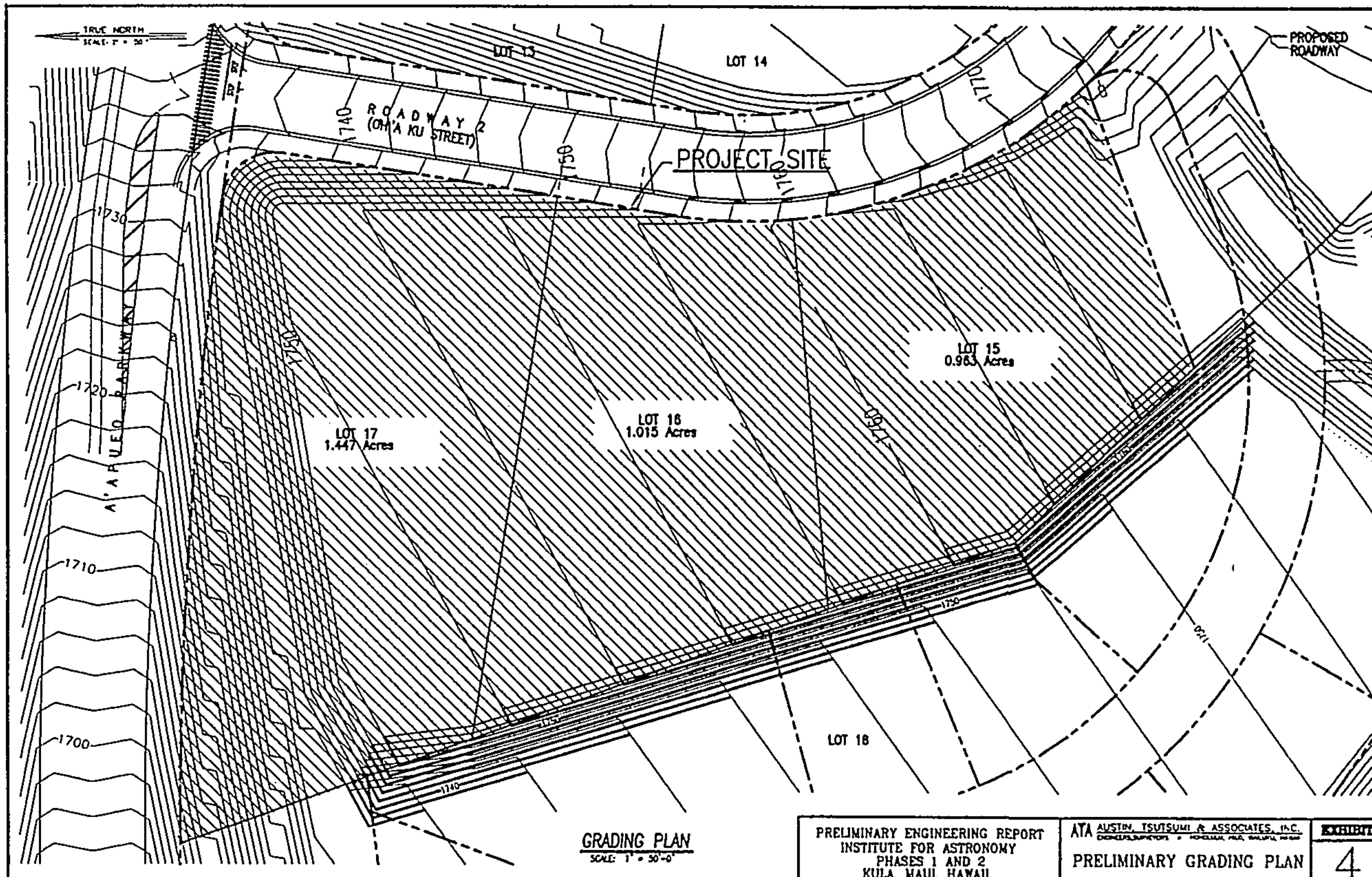

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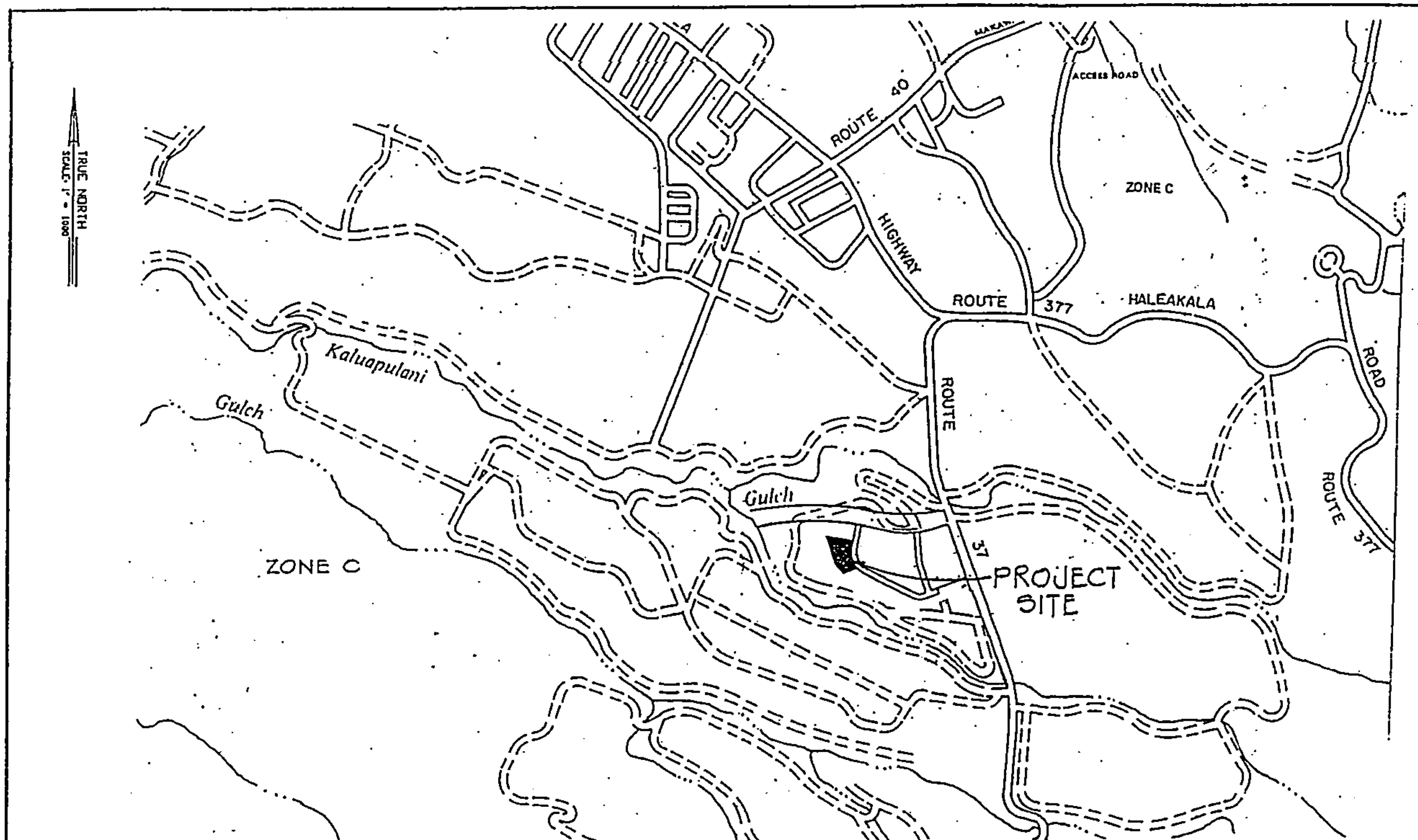

FLOOD ZONE PLAN
SCALE: 1" = 1000'-0"

PRELIMINARY ENGINEERING REPORT INSTITUTE FOR ASTRONOMY PHASES 1 AND 2 KULA, MAUI, HAWAII	AYA AUSTIN, TSUTSUMI & ASSOCIATES, INC. FLOOD ZONE	EXHIBIT 5

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Appendix C

Traffic Impact Analysis Report

TRAFFIC IMPACT ANALYSIS REPORT FOR INSTITUTE FOR ASTRONOMY ADVANCED TECHNOLOGY CENTER (PHASE 1) AND ADVANCED TECHNOLOGY AND RESEARCH CENTER (PHASE 2)

KOHOILA, KULA, MAUI, HAWAII

January 15, 2004

Prepared for:

Kulamalu Science, LLC
2005 Main Street
Wailuku, Hawaii 96793

ATA

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TRAFFIC IMPACT ANALYSIS REPORT
FOR INSTITUTE FOR ASTRONOMY
ADVANCED TECHNOLOGY CENTER (PHASE 1)
AND ADVANCED TECHNOLOGY
AND RESEARCH CENTER (PHASE 2)
Kohoila, Kula, Maui, Hawaii

Prepared for

Kulamalu Science, LLC
2005 Main Street
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Prepared by

Austin, Tsutsumi & Associates, Inc.
Civil Engineers • Surveyors
Honolulu • Wailuku, Hawaii

January 15, 2004

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ATA AUSTIN, TSUTSUMI & ASSOCIATES, INC.
CIVIL ENGINEERS • SURVEYORS

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ATA AUSTIN, TSUTSUMI & ASSOCIATES, INC. CIVIL ENGINEERS • SURVEYORS
CONTINUING THE ENGINEERING PRACTICE FOUNDED BY H. A. R. AUSTIN IN 1934

KENNETH K. KUROKAWA, P.E.
LAMBERT J. YAMASHITA, P.E.
DONOHUE M. FUJII, P.E.
STANLEY T. WATANABE
TERRANCE S. ARASHIRO, P.E.

TRAFFIC IMPACT ANALYSIS REPORT FOR INSTITUTE FOR ASTRONOMY ADVANCED TECHNOLOGY CENTER (PHASE 1) and ADVANCED TECHNOLOGY AND RESEARCH CENTER (PHASE 2) KOHOILA, KULA, MAUI, HAWAII

I. INTRODUCTION

A. Purpose and Scope

This study supplements the Kulamalu Traffic Study, by Austin, Tsutsumi & Associates, Inc. dated October 1997, which addressed the traffic impacts for the ultimate development of the Kulamalu project in Kula, Maui. The traffic impacts resulting from the ultimate development of the Kamehameha Schools Maui Campus, also located within the Kulamalu project, have been addressed by the Draft Traffic Impact Analysis for Kamehameha Schools Maui Campus, by Phillip Rowell and Associates, dated June 20, 2002.

The purpose of this report is to specifically document the findings and recommendations of a traffic study conducted by Austin, Tsutsumi & Associates, Inc., to evaluate the potential incremental traffic impacts resulting from the development of the Institute for Astronomy's (IFA) proposed Advanced Technology Center (ATC) and Advanced Technology and Research Center (ATRC), herein after collectively referred to as the "Project". This traffic study is being specifically conducted as a requirement for the Project as part of the Environmental Assessment process.

REPLY TO:
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OFFICES IN:
HONOLULU, HAWAII
WAILUKU, MAUI, HAWAII

B. Project Location

The proposed Project is located on the Island of Maui, south of Pukalani and west of Kula Highway. The Project site is situated within Lots 15, 16 and 17 of the Kulamalu Town Center Subdivision (aka, Kulamalu Commercial Subdivision), and is more specifically identified as TMK: (2)2-3-08:38 and portion of 39. The Project site has a total area of approximately 3.4 acres. The ATC will be situated on Lot 15 and a portion of Lot 16. The ARTC will be situated on Lot 17 and the remaining portion of Lot 16. The Kulamalu Town Center Subdivision consists of 53.67 acres and is located within the Kulamalu project area. Currently under development, the Kulamalu project area encompasses a mixture of park, school, business, cultural, multi-family residential, single-family residential and public/quasi-public uses. The Project site is currently vacant and was recently mass-graded during site preparation for the Kulamalu Town Center Subdivision.

The Project site is bordered by Aapueo Parkway to the north, Ohia Ku Street to the east, undeveloped lots to the south and Lot 18 (a proposed 12-lot single-family residential subdivision) to the west. Access to the Project site from Kula Highway is via Aapueo Parkway and the future Ohia Ku Street.

Figure 1 shows the location of the Project site.

C. Project Description

The proposed Project consists of two (2) phases as described below.

Phase 1

The ATC will replace the existing IFA Waiakoa Laboratory facilities, which lacks space and state-of-the-art instrumentation to adequately support the IFA's needs. The existing IFA Waiakoa Laboratory is presently located in Kula near the Kula Elementary School.

The proposed ATC will consist of a 15,865 square foot two-story main building, a 28-stall parking lot, landscaping and related site work. The main building will include space for offices, an observation deck, laboratory facilities, etc. The ATC facility will house approximately 30 employees with varying work schedules. Most of the employees will be scientists and engineers that have flexible work schedules or part of research teams that usually start work in the afternoon. The only employees that will have regular work schedules will be the administrative support staff and technicians.

Phase 2

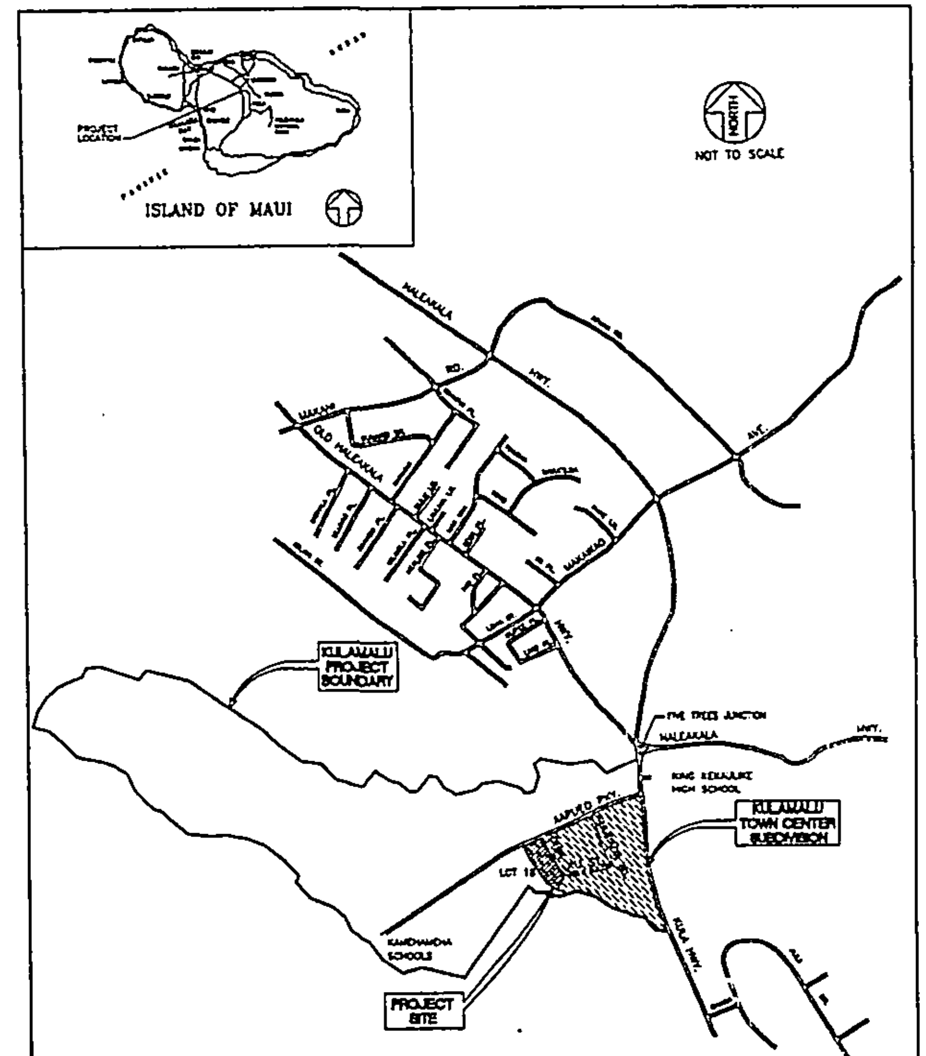
As currently proposed, the ATRC will consist of a main building, annex, lecture hall and plaza. The total floor area of the Phase 2 ATRC buildings will be approximately 44,028 square feet. The Phase 2 ATRC will provide approximately 100 parking stalls in addition to the 28 parking stalls provided by the Phase 1 ATC for a total of 128 parking stalls. The number of additional employees and breakdown of building spaces have not been specifically defined at this time.

Figure 2 shows the proposed site plan for the Project.

D. Study Methodology

This study will address the following:

1. Existing traffic operating conditions.
2. Base year (build-out year of the proposed Project) traffic projections <u>without</u> Project-generated traffic.
3. Trip generation and traffic assignment characteristics for the proposed Project.
4. Determination of the potential impact of Project-generated traffic on the base year traffic operation.
5. Recommendation of traffic mitigation measures as appropriate, to mitigate the traffic impacts resulting from Project-generated traffic.



UNIVERSITY OF HAWAII
INSTITUTE FOR ASTRONOMY

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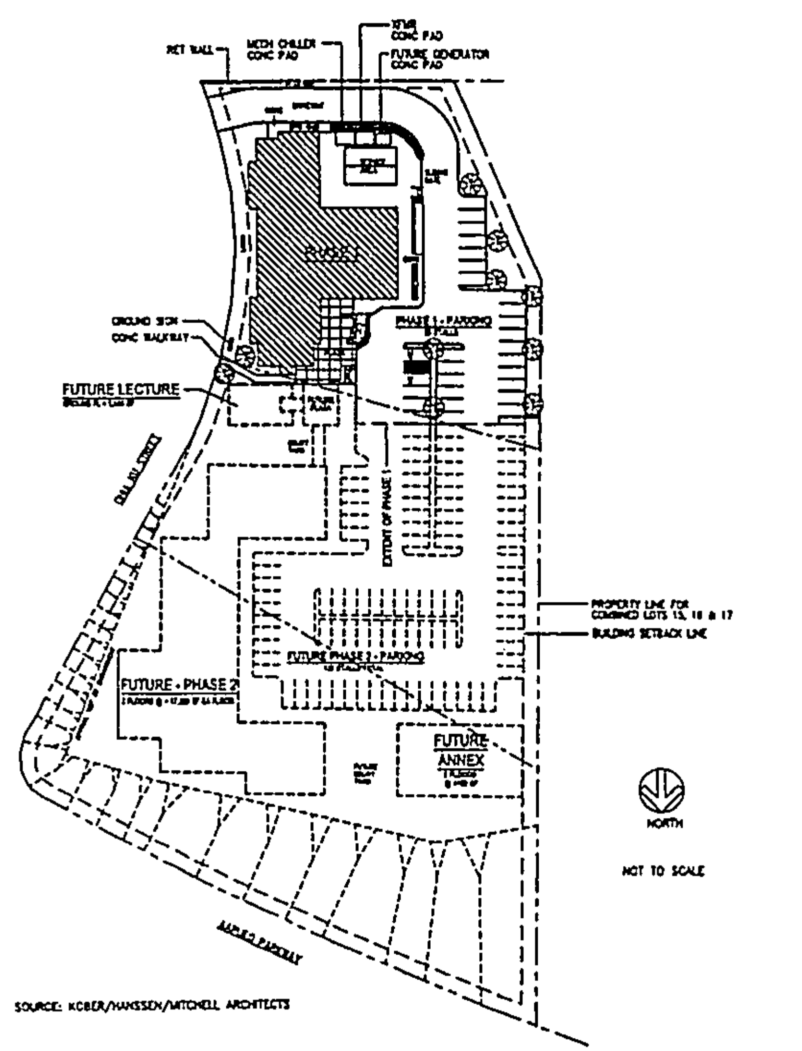
ENGINEERS, SURVEYORS • HONOLULU, HAWAII

PROJECT LOCATION

FIGURE 1



UNIVERSITY OF HAWAII INSTITUTE FOR ASTRONOMY	ATA AUSTIN, TSUTSUMI & ASSOCIATES, INC. ENGINEERS, SURVEYORS • HONOLULU, HAWAII	FIGURE
	SITE PLAN	2

E. General

Description of IFA

The IFA was founded in 1967 to manage the observatories on Haleakala and Mauna Kea. IFA observatories conduct research into galaxies, stars, planets and the Sun. Its faculty and staff are also involved in education and the development of the observatories. The IFA operates facilities on the Islands of Oahu, Hawaii and Maui. Its main base is in Manoa Valley, Oahu, just north of the University of Hawaii at Manoa main campus. IFA employs over 180 people including about 45 faculty members.

Existing IFA Waiakoa Laboratory Operations on Maui

The following description of operations is based on discussions with staff at the existing IFA Waiakoa Laboratory facility. The IFA Waiakoa Laboratory facility in Kula presently houses 20 employees and is used as a 24-hour support/base station for work at the observatories on the summit of Haleakala. There are ten (10) State-owned vehicles that are used for travel to and from the observatories on the summit of Haleakala.

The employees at the IFA Waiakoa Laboratory facility have various work schedules based on their duties. Following is a description of employment characteristics at the IFA Waiakoa Laboratory facility:

- There are a total of 20 employees at the IFA Waiakoa Laboratory facility.
- There are a total of six (6) administrative support staff and technicians who have regular work schedules from 8:00 AM to 5:00 PM.
- The scientists and engineers have flexible hours and start work between 7:00 AM and 8:30 AM; their work schedule is largely based on the viewing conditions at the summit of Haleakala Crater and their workdays can typically exceed eight (8) hours.

- There is usually one (1) operator at the IFA who works the night shift and leaves one (1) hour before sunrise.
- There are also three (3) two-person teams that are part of a satellite laser ranging team that usually starts work in the afternoon depending on the viewing conditions.

All of the scientists and engineers check in at the IFA Walakoa Laboratory facility to perform administrative tasks before journeying to the summit and check in before leaving at the end of the workday. The end of the workday varies for the scientists, engineers and research teams, as their workday is dependent on the viewing conditions at the Haleakala summit.

II. EXISTING CONDITIONS

A. Roadway System

The following is a brief description of the existing roadway network in the vicinity of the Project:

Haleakala Highway is generally a two-lane, State highway that links Kahului with Haleakala National Park. The roadway intersects Hana Highway in Kahului on the west side of Kahului Airport. Haleakala Highway is generally oriented in the east-west direction, beginning in Kahului, intersecting Old Haleakala Highway and Kula Highway at the Five Trees Junction and terminating at Haleakala National Park. Haleakala Highway is a three-lane facility from Hana Highway to Makawao Avenue with two lanes in the eastbound (mauka) direction and a single lane in the westbound (makai) direction. Haleakala Highway has a posted speed limit of 45 miles per hour (mph) on the section between Makawao Avenue and the Five Trees Junction. East of the Five Trees Junction, Haleakala Highway has a posted speed limit of 30 mph except for the section fronting King Kekaulike High School, where the posted speed limit is reduced to 25 mph during the morning and afternoon peak periods of school traffic.

Kula Highway is a two-lane, rural, arterial, State highway that connects the Pukalani area with the Ulupalakua area. Kula Highway is generally oriented in the north-south direction and begins in Pukalani at the Five Trees Junction of

Old Haleakala Highway and Haleakala Highway. (Kula Highway eventually becomes Piilani Highway south of the study area.) In the vicinity of the Project site, Kula Highway has a posted speed limit of 45 mph. Fronting King Kekaulike High School, the posted speed limit is reduced to 25 mph during the morning and afternoon peak hours of school traffic. Fronting Kula Elementary School, the posted speed limit is reduced to 20 mph during school hours.

Old Haleakala Highway is a two-lane, County collector road that serves the Pukalani area. Old Haleakala Highway provides a parallel route to Haleakala Highway through the town of Pukalani. Old Haleakala Highway is oriented in the north-south direction as it intersects with Haleakala Highway approximately one-half mile east of Haliimaile Road and changes to an east-west roadway through Pukalani and terminates at the Five Trees Junction at Haleakala Highway and Kula Highway. Old Haleakala Highway has a posted speed limit of 35 mph.

Makani Road is a two-lane, County collector road that serves Pukalani town and Makawao town. Makani Road is generally oriented in the north-south direction, originating within Pukalani at its intersection with Old Haleakala Highway, and extending northeasterly to eventually intersect with Makawao Avenue.

Pukalani Street is a two-lane, County collector roadway serving residential and commercial areas in Pukalani town. Pukalani Street is generally oriented in the north-south direction, originating at its intersection with Old Haleakala Highway, and extending southwesterly to the Pukalani Country Club Golf Course.

Within the study area, Makawao Avenue is a two-lane, County collector road that serves Pukalani town and Makawao town. Makawao Avenue is generally oriented in the north-south direction, originating within Pukalani at its intersection with Old Haleakala Highway, and extending northeasterly through Makawao town. North of its intersection with Baldwin Avenue, Makawao Avenue terminates across from Kaupakulua Road.

Loha Street is a two-lane, County collector roadway serving residential areas in Pukalani. Loha Street is a continuation of Makawao Avenue south of its intersection with Old Haleakala Highway.

Aapueo Parkway - Is presently a two-lane, east-west, private (at the time of writing this report, it was signed as part of an active construction site not open to the public) collector roadway with a posted speed limit of 20 mph. Aapueo Parkway will be eventually dedicated to the County of Maui and serves as the only access to the Kamehameha Schools Maui Campus and the Kulamalu development.

B. Study Intersections

Weekday peak period of traffic turning movement count surveys were conducted by Austin, Tsutsumi & Associates, Inc. on Thursday, May 1, 2003, morning (AM) and on Wednesday, April 30, 2003 afternoon (PM) at the following study intersections:

- Haleakala Highway/Old Haleakala Highway (Western Intersection) - unsignalized
- Haleakala Highway/Makani Road - unsignalized
- Haleakala Highway/Makawao Avenue - signalized
- Haleakala Highway/Kula Highway/Old Haleakala Highway (Five Trees Junction) - signalized
- Old Haleakala Highway/Pukalani Street - signalized
- Old Haleakala Highway/Makawao Avenue/Loha Street - signalized
- Kula Highway/King Kekaulike High School (KKHS) Driveway/ Residential Driveway - unsignalized
- Kula Highway/Aapueo Parkway - unsignalized

At the Haleakala Highway/Old Haleakala Highway (Western Intersection), Old Haleakala Highway makes a 90-degree turn to intersect Haleakala Highway at a modified "tee" intersection. Old Haleakala Highway is the northbound approach at this unsignalized intersection and is controlled by a stop sign. The Old Haleakala Highway approach is striped with exclusive lanes for left-turn and right-turn traffic. Right-turn traffic on the Old Haleakala Highway northbound approach is yield sign-controlled and channelized by a traffic island. The Haleakala Highway westbound approach is striped with a single through lane, as

westbound left-turns are not allowed at this intersection. The Haleakala Highway eastbound approach is striped with two (2) through lanes and an exclusive right-turn lane. Right-turn traffic from the eastbound approach is "free" as this movement is channelized by a traffic island.

A contraflow operation on Haleakala Highway is implemented during the weekday AM peak period of traffic. When the contraflow operation is in effect, all traffic on the Haleakala Highway eastbound approach is forced to exit via right-turn onto Old Haleakala Highway and right-turns from the Old Haleakala Highway approach onto Haleakala Highway are prohibited. As a result of the AM contraflow operation, there is no conflicting traffic for the northbound to westbound left-turn movement from the Old Haleakala Highway approach. The AM contraflow operation is discussed in more detail in the "Field Observations" section.

Haleakala Highway/Makani Road is an unsignalized "cross" intersection with traffic on Makani Road controlled by a stop sign. The Makani Road northbound and southbound approaches are striped with a shared left-turn/through lane and an exclusive right-turn lane. Right-turn traffic on the northbound and southbound approaches is channelized by traffic islands and is yield sign-controlled. The Haleakala Highway westbound approach is striped with an exclusive left-turn lane and a shared through/right-turn lane. The Haleakala Highway eastbound approach is striped with an exclusive left-turn lane, a through lane, and a shared through/right-turn lane. Right-turn traffic from the westbound and eastbound approaches is yield sign-controlled.

Haleakala Highway/Makawao Avenue is a signalized "cross" intersection. The Makawao Avenue northbound and southbound approaches and the Haleakala Highway westbound approach provide exclusive lanes for left-turn traffic, through traffic and right-turn traffic. The Haleakala Highway eastbound approach is striped with an exclusive left-turn lane, two through lanes and an exclusive right-turn lane. Right-turn traffic on each approach is yield sign-controlled and channelized by raised traffic islands.

<u>Haleakala Highway/Kula Highway/Old Haleakala Highway</u> (Five Trees Junction) is a signalized "cross" intersection. Haleakala Highway is the southbound and westbound approaches of the intersection (Haleakala Highway makes a 90 degree turn at this intersection). Kula Highway is the northbound approach and Old Haleakala Highway is the eastbound approach at this intersection. The northbound Kula Highway and southbound Haleakala Highway approaches provide exclusive lanes for left-turn traffic, through traffic and right-turn traffic. The westbound Haleakala Highway and eastbound Old Haleakala Highway approaches are striped with a shared left-turn/through lane and exclusive right-turn lane. Right-turn traffic on each approach is yield sign-controlled and channelized by raised traffic islands.

<u>Old Haleakala Highway/Pukalani Street</u> is a signalized "tee" intersection with Pukalani Street as the stem. The northbound Pukalani Street approach provides exclusive lanes for left-turn traffic and right-turn traffic. The Old Haleakala Highway westbound approach is striped with an exclusive left-turn lane and a through lane. The Old Haleakala Highway eastbound approach is striped with a through lane and an exclusive right-turn lane.

<u>Old Haleakala Highway/Makawao Avenue/Loha Street</u> is a signalized "cross" intersection. The Loha Street northbound and Old Haleakala westbound approaches provide a single lane, which is striped as a shared left-turn/through/right-turn lane. The southbound Makawao Avenue approach is striped with a shared left-turn/through lane and an exclusive right-turn lane. The Old Haleakala Highway eastbound approach is striped with an exclusive left-turn lane and a shared through/right-turn lane.

<u>Kula Highway/King Kekaulike High School (KKHS) Driveway/Residential Driveway</u> is an unsignalized "cross"-intersection. The southbound Kula Highway approach is striped with an exclusive left-turn lane and a shared through/right-turn lane. The northbound Kula Highway approach is striped with an exclusive right-turn lane that is yield sign-controlled and a shared left-turn/through lane. The westbound KKHS and eastbound residential driveway approaches are stop sign-controlled. The KKHS driveway is striped with an exclusive right-turn lane and exclusive left-turn lane. The residential driveway is striped with a single lane shared approach.

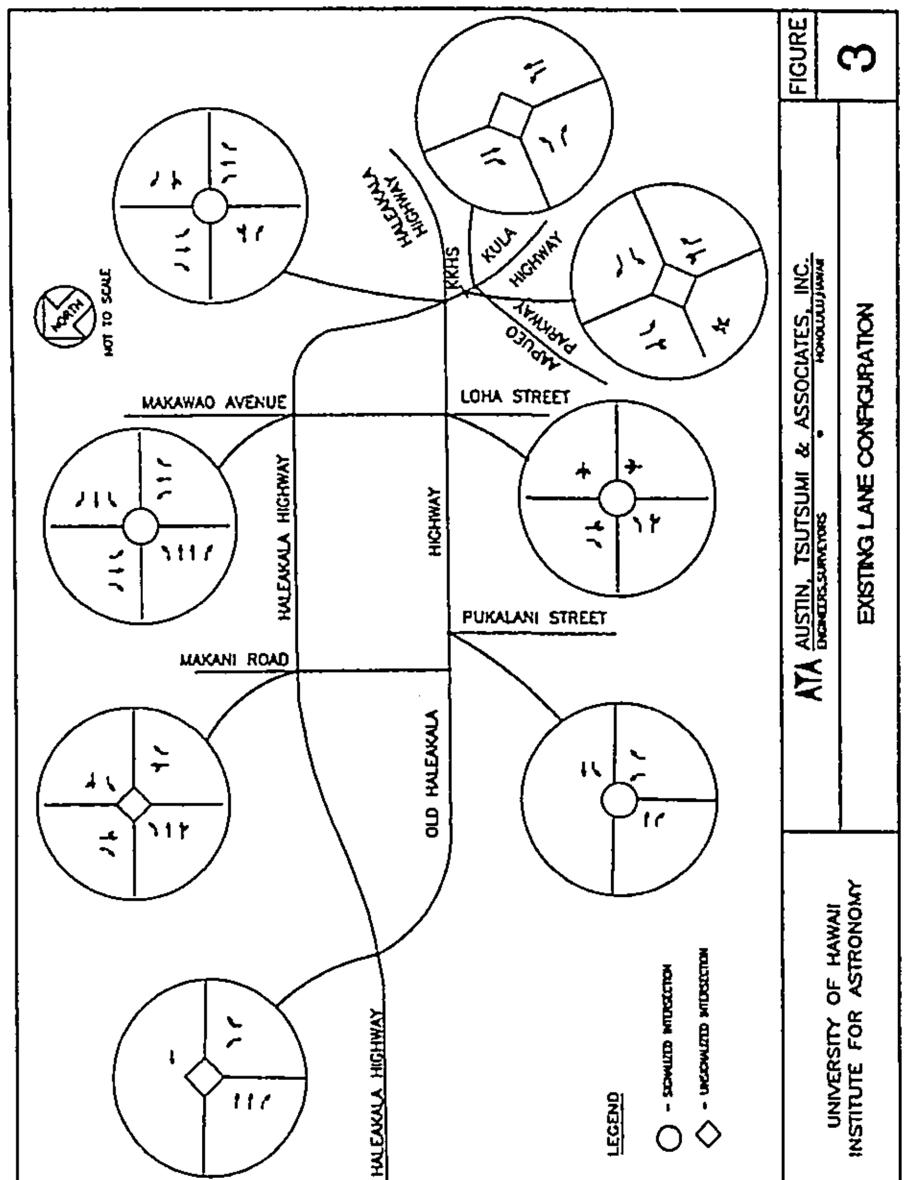
<u>Kula Highway/Aapueo Parkway</u> is an unsignalized "tee"-intersection with Aapueo Parkway as the stop sign-controlled stem. The northbound Kula Highway approach is striped with an exclusive left-turn lane and a through lane. The southbound Kula Highway approach is striped with an exclusive right-turn lane and a through lane. The eastbound Aapueo Parkway approach is striped with an exclusive left-turn lane and an exclusive right-turn lane.

Figure 3 shows the existing traffic lane configurations at the study intersections.

C. Field Observations

The weekday AM and PM peak hours of traffic were determined to occur from 7:00 AM to 8:00 AM and 3:30 PM to 4:30 PM, respectively. In the morning, the peak for traffic generated by KKHS and traffic on Aapueo Parkway (Kamehameha Schools Maui Campus and construction traffic) generally occur within the same time frame as the commuter peak traffic on Kula Highway. In the afternoon, traffic generated by KKHS and Kamehameha Schools Maui Campus peaks earlier than the PM peak hour of commuter traffic. Only the AM and PM peak hours of commuter traffic are considered in this study since the Project is not expected to generate a significant amount of traffic during the PM peak hour of school traffic. The traffic count data is provided in Appendix A.

The State of Hawaii Department of Transportation (SDOT) implements a contraflow operation on Haleakala Highway from the Haleakala Highway/Old Haleakala Highway (Western Intersection) to the Haleakala Highway/Hana Highway intersection during the weekday AM peak period of traffic. An eastbound lane is used for westbound travel on Haleakala Highway during the AM contraflow operation. All eastbound traffic on Haleakala Highway originating downstream of Old Haleakala Highway is diverted onto Old Haleakala Highway during the contraflow operation. Access to eastbound Haleakala Highway from the Haleakala Highway/Old Haleakala Highway (Western Intersection) to the Five Trees Junction is limited to traffic from Makani Road and Makawao Avenue only.



It was observed that northbound through vehicles on Kula Highway frequently yield to southbound vehicles turning left into the KKHS driveway during the 20-minute period before the start of the KKHS school day (8:00 AM). This results in additional delays for northbound traffic on Kula Highway as a long queue of northbound vehicles extending well past the Aapueo Parkway intersection was observed. As a result of the long queue of northbound vehicles from KKHS, northbound vehicles on Kula Highway were also observed to frequently yield to eastbound vehicles turning left onto the highway from Aapueo Parkway. After 8:00 AM, traffic volumes tapered off quickly and the queue of northbound vehicles dissipated. Traffic volumes entering and exiting KKHS were much lower and queuing at this intersection was much lighter during the PM peak hour of traffic. This is expected since the PM peak hour for school traffic does not coincide with the PM peak hour of commuter traffic as the KKHS school day ends at 2:00 PM.

D. Traffic Operations

Level of service (LOS) is a qualitative measure used to describe the condition of traffic flow, ranging from free-flow conditions at LOS A to congested conditions at LOS F. The Highway Capacity Manual – HCM 2000 methodology for calculating levels of service was used in this study. LOS definitions for unsignalized and signalized intersections are provided in Appendix B. LOS calculations are provided in Appendix C. It should be noted that overall LOS for unsignalized intersections is no longer calculated in the HCM 2000 procedure; LOS is only calculated for the stop sign-controlled (minor) approaches and for left-turn traffic from the major roadway.

The LOS analysis results for existing traffic conditions at the study intersections are described below. Table 1 summarizes the existing LOS at the study intersections. Figure 4 shows the existing traffic volumes and LOS at the study intersections during the AM and PM peak hours of traffic. The traffic volumes shown on Figure 4 include traffic associated with current construction activity for the Kamehameha Schools Maui Campus expansion that was observed at the west end of Aapueo Parkway. The LOS analysis assumes that drivers behave according to traffic controls at the intersection and does not account for delays caused by vehicles on Kula Highway yielding to vehicles turning into and out of the KKHS driveway and vehicles turning out of Aapueo Parkway during the AM peak hour of traffic.

Haleakala Highway/Old Haleakala Highway (Western Intersection)

During the AM peak hour of traffic, all movements at this intersection have no conflicting flow since eastbound traffic on Haleakala Highway (499 vehicles during the AM peak hour of traffic) is diverted onto Old Haleakala Highway because of the AM contraflow operation. During the AM peak hour of traffic, 1,173 vehicles from Haleakala Highway and 758 vehicles from Old Haleakala Highway were headed westbound towards Kahului. Most of these vehicles appear to be going to work in other areas of Maui. During the PM peak hour of traffic, all individual movements at this unsignalized intersection operate at LOS D or better except for northbound left-turn traffic on Old Haleakala Highway, which operates at LOS F. A review of 24-hour traffic count data collected in 2001 by SDOT indicates that traffic volumes at this intersection meet the four-hour warrant for the installation of a traffic signal system as described in the Manual on Uniform Traffic Control Devices - Millennium Edition (MUTCD-2000).

Haleakala Highway/Makani Road

All individual movements at this unsignalized intersection operate at LOS D or better during the AM and PM peak hours of traffic except for the following. The Makani Road northbound shared left-turn/through traffic operates at LOS E during the AM peak hour of traffic and LOS F during the PM peak hour of traffic. The Makani Road southbound shared left-turn/through traffic operates at LOS F during the AM and PM peak hours of traffic. Southbound right-turn traffic operates at LOS F during the AM peak hour of traffic. The southbound right-turn volume is high (344 vehicles) during the AM peak hour of traffic because vehicles coming from Makawao Town bypass the Makawao Avenue/Haleakala Highway intersection and instead use Makani Road to turn right onto westbound Haleakala Highway. A review of 24-hour traffic count data collected in 2001 by SDOT indicates that traffic volumes at this intersection meet the eight-hour and four-hour warrants for the installation of a traffic signal system as described in the MUTCD-2000. Installation of a traffic signal system at this intersection is planned by SDOT and for the purposes of this study assumed to be operational by the Year 2005.

Haleakala Highway/Makawao Avenue

This signalized intersection operates overall at LOS C during the AM and PM peak hours of traffic. All individual movements at this intersection operate at LOS D or better during the AM and PM peak hours of traffic. Queuing was observed on the Makawao Avenue southbound approach during the AM peak hour of traffic. The southbound queue averaged over ten vehicles, extending beyond the exclusive right-turn lane on Makawao Avenue and blocking vehicles from making a right-turn to westbound Haleakala Highway. As a result, southbound vehicles coming from Makawao Town also utilize Makani Road to turn right onto westbound Haleakala Highway.

Haleakala Highway/Kula Highway/Old Haleakala Highway (Five Trees Junction)

This signalized intersection operates overall at LOS C during the AM peak hour of traffic and LOS B during the PM peak hour of traffic. All individual movements at this intersection operate at LOS D or better during the AM and PM peak hours of traffic. Traffic queues averaging eight to ten vehicles were observed on the northbound Kula Highway approach and on the westbound Haleakala Highway approach during the AM peak period of traffic. During the AM peak hour of traffic, 420 vehicles turned right from eastbound Old Haleakala Highway to southbound Kula Highway. This heavy right-turn volume is in part due to the AM contraflow operation on Haleakala Highway west of the study area. During the PM peak period of traffic, the average queue length was observed to be about three to four vehicles on the westbound Haleakala Highway approach.

Old Haleakala Highway/Pukalani Street

This signalized intersection operates overall at LOS C during the AM peak hour of traffic and LOS B during the PM peak hour of traffic. All individual movements at this intersection operate at LOS D or better during the AM and PM peak hours of traffic. During the AM peak hour of traffic, 551 vehicles turned left from Pukalani Street to westbound Old Haleakala Highway. Most of these vehicles appear to be headed to work in other areas of Maui via Haleakala Highway.

Old Haleakala Highway/Makawao Avenue/Loha Street

This signalized intersection operates overall at LOS B during the AM and PM peak hours of traffic. All individual movements at this intersection operate at LOS D or better during the AM and PM peak hours of traffic. Vehicle queues at this intersection were minimal and able to clear with every cycle.

Kula Highway/King Kekaulike High School (KKHS) Driveway/Residential Driveway

All individual movements at this unsignalized intersection operate at LOS D or better during the AM and PM peak hours of traffic except for the following. Westbound left-turn traffic from KKHS and eastbound traffic on the shared driveway approach operate at LOS F during the AM peak hour of traffic and at LOS E during the PM peak hour of traffic. However, few vehicles use the shared driveway approach, five (5) vehicles and three (3) vehicles during the AM and PM peak hours, respectively. During the AM peak hour of traffic, a total of 362 vehicles entered and 143 vehicles exited KKHS at this intersection. The existing traffic volumes at this intersection during the AM and PM peak hours of traffic do not meet the peak hour warrant for the installation of a traffic signal system as described in the MUTCD-2000.

Kula Highway/Aapueo Parkway

All individual movements at this unsignalized intersection operate at LOS D or better during the AM and PM peak hours of traffic except for eastbound left-turn traffic on Aapueo Parkway, which operates at LOS F during the AM and PM peak hours of traffic. The existing traffic volumes at this intersection during the AM and PM peak hours of traffic meet the peak hour warrant for the installation of a traffic signal system as described in the MUTCD-2000. A traffic signal system was also warranted under existing conditions described in the findings of the Draft Traffic Impact Analysis for Kamehameha Schools Maui Campus. A traffic signal system at this intersection is currently in the design process and for the purposes of this study assumed to be constructed by Year 2005.

Table 1
LOS at Study Intersections
Existing Conditions

	Existing	
	AM Peak	PM Peak
Haleakala Highway/Old Haleakala Highway (Western Intersection)		
NB LT	--	F
NB RT	--	B
Haleakala Highway/Makani Road		
NB LT/TH	E	F*
NB RT	A	B
SB LT/TH	F*	F*
SB RT	F*	B
WB LT	A	A
EB LT	A	A
Haleakala Highway/Makawao Avenue		
NB LT	B	B
NB TH	B	C
NB RT	B	A
SB LT	D	D
SB TH	B	B
SB RT	B	A
WB LT	C	C
WB TH	C	C
WB RT	B	C
EB LT	D	C
EB TH	B	B
EB RT	B	B
Overall	C	C
Haleakala Highway/Kula Highway/Old Haleakala Highway (Five Trees Junction)		
NB LT	C	C
NB TH	C	B
SB LT	C	C
SB TH	B	B
SB RT	B	B
WB LT/TH	C	C
EB LT/TH	C	C
Overall	C	B

*V/c (volume to capacity ratio) > 1.0

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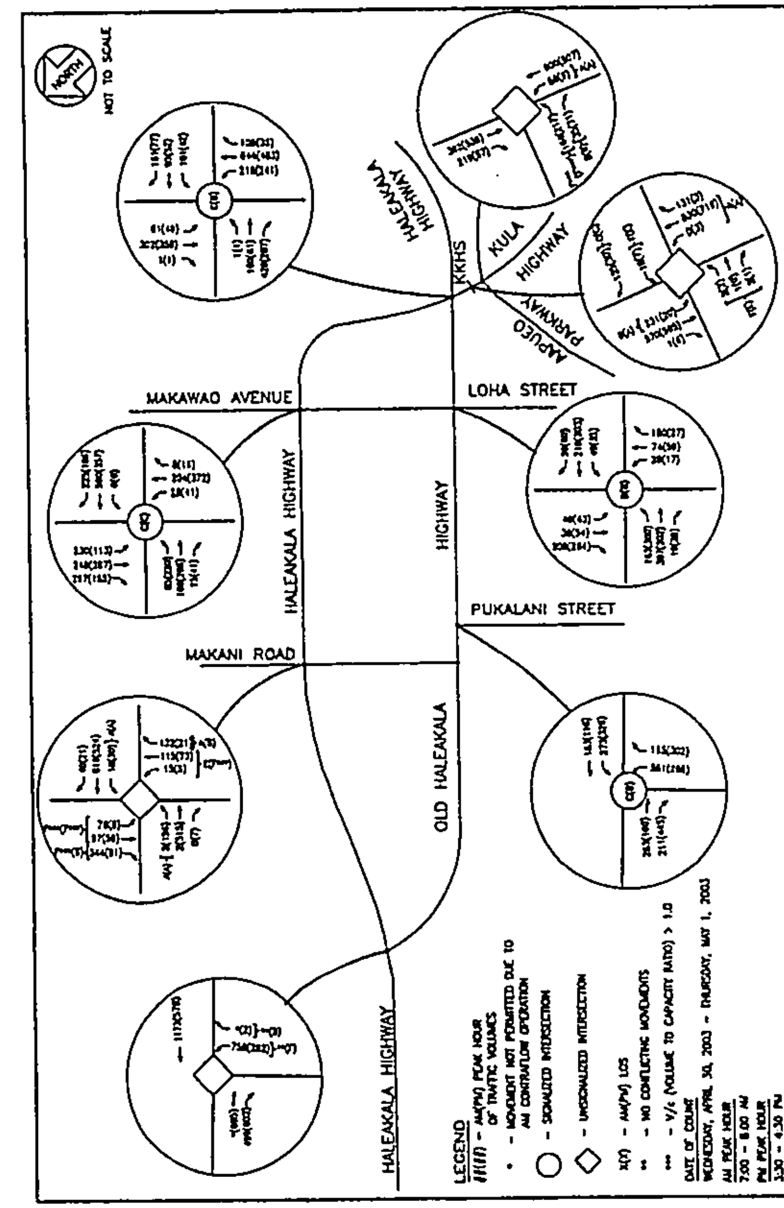
Table 1 (continued)
LOS at Study Intersections
Existing Conditions

	Existing	
	AM Peak Hour	PM Peak Hour
Old Haleakala Highway/Pukalani Street		
NB LT	C	B
NB RT	A	B
WB LT	C	B
WB TH	B	A
EB TH	C	B
EB RT	A	A
Overall	C	B
Old Haleakala Highway/Makawao Avenue/Loha Street		
NB LT/TH/RT	B	B
SB LT/TH	B	B
SB RT	C	C
WB LT/TH/RT	B	B
EB LT	A	A
EB TH/RT	A	A
Overall	B	B
Kula Highway/KKHS Driveway/Residential Driveway		
NB LT/TH	A	A
SB LT	B	A
WB LT	F	E
WB RT	C	C
EB LT/TH/RT	F	E
Kula Highway/Aapueo Parkway		
NB LT	A	A
EB LT	F*	F*
EB RT	B	B

*V/c (volume to capacity ratio)>1.0



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EXISTING TRAFFIC VOLUMES
AND LEVEL OF SERVICE

FIGURE 4

III. BASE YEAR TRAFFIC CONDITIONS WITHOUT PROJECT

Phase 1, the ATC, is estimated to be completed in Year 2005 and Phase 2, the ATRC, is estimated to be completed in Year 2006. Therefore, Year 2005 and Year 2006 were chosen to represent base conditions without Project-generated traffic.

Traffic believed to be associated with current construction activity for the Kamehameha Schools Maui Campus expansion was estimated based on the number of construction workers given by the contractor. Construction trips were subtracted from existing traffic counts because they will no longer be generated by the construction project after the Kamehameha Schools Maui Campus expansion is complete. The resulting volumes were increased by applying an annual vehicular growth rate of 1.3 percent per year, which is the approximate annual vehicular growth rate projected for the major roadways in the Pukalani area based on information contained in the Maui Long-Range Land Transportation Plan (MLRLTP), dated February 1997.

At the time of writing this study, the widening of Haleakala Highway to four lanes from Hana Highway to Old Haleakala Highway (Western Intersection) by SDOT is anticipated to be completed within the 2005-2006 timeframe. SDOT has indicated that once Haleakala Highway is widened, the AM contraflow operation will be discontinued and vehicles on the Haleakala Highway eastbound approach to Old Haleakala Highway (Western Intersection) will no longer be forced to turn right onto Old Haleakala Highway during the AM peak period of traffic. Projected traffic volumes for the AM peak hour of traffic were reassigned to the roadway network assuming the discontinuation of the AM contraflow operation on Haleakala Highway. Projected traffic volumes for the PM peak hour of traffic was not adjusted since there is no contraflow operations during the PM peak hour.

A. Base Year 2005 Without Project

The following are descriptions of known new/future developments that are expected to generate significant traffic demand within the study area and anticipated to be completed by 2005. Traffic generated by these projects are included in Base Year 2005 traffic projections for this study.

1. Kulamalu Development

At the time of writing this study, various known projects were anticipated to be completed within the 2005 timeframe as part of the planned Kulamalu development. These projects include a county park of approximately 9.3-acres, the 12-dwelling unit single-family Kulamalu Hilltop Subdivision and the Kulamalu Mauka Subdivision which will consist of office and commercial uses. Peak hour vehicular trips generated by these projects were estimated by applying appropriate trip generation rates in Trip Generation, 6th Edition, published by the Institute of Transportation Engineers (ITE). It is unknown at this time exactly what type of developments will be constructed within the Kulamalu Mauka Subdivision. The Kulamalu Mauka Subdivision was assumed to consist of a mix of 25 percent office and 75 percent retail by floor area (17,420 square feet (SF) of office space and 52,250 SF of retail space) for the purpose of estimating background traffic for this study.

According to the Kamehameha Schools Maui Campus website, the Maui campus, which is also a part of the Kulamalu development, had an enrollment of about 600 students in grades K through 9 at the time the traffic count survey was conducted. Addition of one grade level every year is planned, which will expand the campus to a full enrollment of about 1,100 students in grades K through 12 by the 2005 school year. Vehicular trips generated by the expansion of the Kamehameha Schools Maui Campus during the AM peak hour of traffic were obtained from the Draft Traffic Impact Analysis for Kamehameha Schools Maui Campus by Phillip Rowell and Associates, dated June 2002. Vehicular trips generated by the expansion of the Kamehameha Schools Maui Campus during the PM peak hour of traffic were estimated by applying trip generation rates for the peak hour of adjacent street traffic contained in ITE, Trip Generation, 6th Edition since the school peak hour of traffic is not likely to coincide with the 3:30 PM to 4:30 PM commuter peak hour of traffic on Kula Highway.

2. **Kula Residence Unit 1**

In addition, the Department of Hawaiian Home Lands (DHHL) has constructed 321 lots known as Kula Residence Unit 1, a single-family residential subdivision located south of the Project site off of Kula Highway in Waiohuli. Owners of these lots are responsible for construction of their own homes. As of March 2003, 102 lots were occupied. Peak hour trips generated by the development of the remaining vacant lots in Kula Residence Unit 1 were estimated based on the existing number of occupied lots and existing traffic volumes entering and exiting the subdivision.

3. **Kualono Subdivision**

The Kualono Subdivision will be located off of Old Haleakala Highway just west of the Five Trees Junction, and will consist of approximately 49 single-family house lots and adjacent 9.232 acre park. Construction of the roadways and infrastructure for the Project is anticipated to be completed by the first quarter of 2005 after which owners of the house lots can begin construction of individual single-family homes at their leisure. Vehicular trips generated by the Kualono Subdivision were obtained from the Traffic Impact Analysis Report for the Kualono Subdivision by Austin, Tsutsumi and Associates, Inc., dated December 1, 2003.

Table 2 shows the trips generated during the peak hour of traffic by the known developments near the Project that are anticipated to be completed by Year 2005 excluding Project-generated trips.

Table 2
Base Year 2005 Peak Hour of Traffic
Trips Generated by Known Developments Near the Project

	AM Peak		PM Peak	
	Enter	Exit	Enter	Exit
County Park (9.3 Acres)	3	1	2	4
Kulamalu Hilltop Subdivision (12 units)	4	14	10	6
Kulamalu Mauka Subdivision	41	6	75	159
Expansion of Kamehameha Schools Maui Campus (grades K-12)	218	145	30	45
Kula Residence Unit 1 (219 remaining lots)	44	50	53	31
Kualono Subdivision (49 lots)	14	34	38	24
Total	324	250	208	269

B. **Base Year 2005 Traffic Operations Without Project-Generated Traffic**

The Base Year 2005 traffic conditions without traffic generated by the IFA are described below. Analysis of Base Year 2005 traffic conditions without the Project indicates traffic at the study intersections will operate at LOS D or better except at the following locations. Table 3 summarizes the Base Year 2005 LOS at the study intersections. Figure 5 shows the Base Year 2005 traffic volumes and LOS at the study intersections during the AM and PM peak hours of traffic.

The LOS analysis assumes that drivers behave according to traffic controls and does not account for delays caused by vehicles on Kula Highway yielding to vehicles turning into and out of the KKHS driveway and vehicles turning out of Aapueo Parkway during the AM peak hour of traffic. If drivers continue to behave inconsistently with traffic controls, northbound through vehicles on Kula Highway will experience LOS F conditions in the vicinity of KKHS and Aapueo Parkway during the 20-minute period before the start of the KKHS school day (8:00 AM).

Haleakala Highway/Old Haleakala Highway (Western Intersection)

According to the current roadway design from SDOT, the additional westbound lane on Haleakala Highway provided by the widening will originate as the receiving lane for northbound left-turn traffic from Old Haleakala Highway at its western intersection with Haleakala Highway. As an unsignalized intersection, northbound left-turn traffic will operate at LOS F during the AM and PM peak hours of traffic.

Haleakala Highway/Makawao Avenue

This signalized intersection will operate overall at LOS D during the AM peak hour of traffic and LOS C during the PM peak hour of traffic. The southbound left-turn and eastbound left-turn traffic will operate at LOS E during the AM peak hour of traffic.

Kula Highway/KKHS Driveway/Residential Driveway

Westbound left-turn traffic from KKHS will operate at LOS F during the AM and PM peak hours of traffic. Westbound right-turn traffic from KKHS will operate at LOS E during the AM peak hour of traffic. Eastbound traffic on the shared driveway approach will operate at LOS F during the AM and PM peak hours of traffic. However, few vehicles are projected to use the shared driveway approach, ten (10) vehicles during the AM peak hour of traffic and ten (10) vehicles during the PM peak hour of traffic. The projected Base Year 2005 traffic volumes at this intersection during the AM and PM peak hours of traffic do not meet the peak hour warrant for the installation of a traffic signal system as described in the MUTCD-2000.

The installation of a traffic signal system at the Haleakala Highway/ Makani Road intersection will result in traffic operating overall at LOS D during the AM peak hour of traffic and LOS A during the PM peak hour of traffic. All individual movements will operate at LOS D or better.

The installation of a traffic signal system at the Kula Highway/Aapueo Parkway intersection will result in traffic operating at overall LOS B during the AM peak hour of traffic and LOS A during the PM peak hour of traffic. All individual movements will operate at LOS D or better.

Table 3
LOS at Study Intersections
Base Year 2005 Without Project

	Existing		Base Year 2005	
	AM Peak Hour	PM Peak Hour	AM Peak Hour	PM Peak Hour
Haleakala Highway/Old Haleakala Highway (Western Intersection)				
NB LT	--	F	F*	F*
NB RT	--	B	A	B
Haleakala Highway/Makani Road				
NB LT/TH	E	F*	--	--
NB RT	A	B	--	--
SB LT/TH	F*	F*	--	--
SB RT	F*	B	--	--
WB LT	A	A	--	--
EB LT	A	A	--	--
Haleakala Highway/Makani Road (signalized)				
NB LT/TH	--	--	C	C
NB RT	--	--	C	C
SB LT/TH	--	--	C	C
SB RT	--	--	D	C
WB LT	--	--	B	A
WB TH/RT	--	--	D	A
EB LT	--	--	B	A
EB TH/RT	--	--	A	A
Overall	--	--	D	A

*V/c (volume to capacity ratio) > 1.0

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Table 3 (continued)
LOS at Study Intersections
Base Year 2005 Without Project

	Existing		Base Year 2005	
	AM Peak Hour	PM Peak Hour	AM Peak Hour	PM Peak Hour
Haleakala Highway/Makawao Avenue				
NB LT	B	B	C	B
NB TH	B	C	C	C
NB RT	B	A	B	A
SB LT	D	D	E	D
SB TH	B	B	C	B
SB RT	B	A	B	A
WB LT	C	C	D	C
WB TH	C	C	D	D
WB RT	B	C	C	C
EB LT	D	C	E	D
EB TH	B	B	B	B
EB RT	B	B	B	B
Overall	C	C	D	C
Haleakala Highway/Kula Highway/Old Haleakala Highway (Five Trees Junction)				
NB LT	C	C	D	C
NB TH	C	B	D	B
SB LT	C	C	D	C
SB TH	B	B	C	C
SB RT	B	B	B	B
WB LT/TH	C	C	D	C
EB LT/TH	C	C	C	C
Overall	C	B	D	C
Old Haleakala Highway/Pukalani Street				
NB LT	C	B	B	B
NB RT	A	B	A	B
WB LT	C	B	C	B
WB TH	B	A	B	A
EB TH	C	B	C	B
EB RT	A	A	A	A
Overall	C	B	B	B

*V/c (volume to capacity ratio) > 1.0

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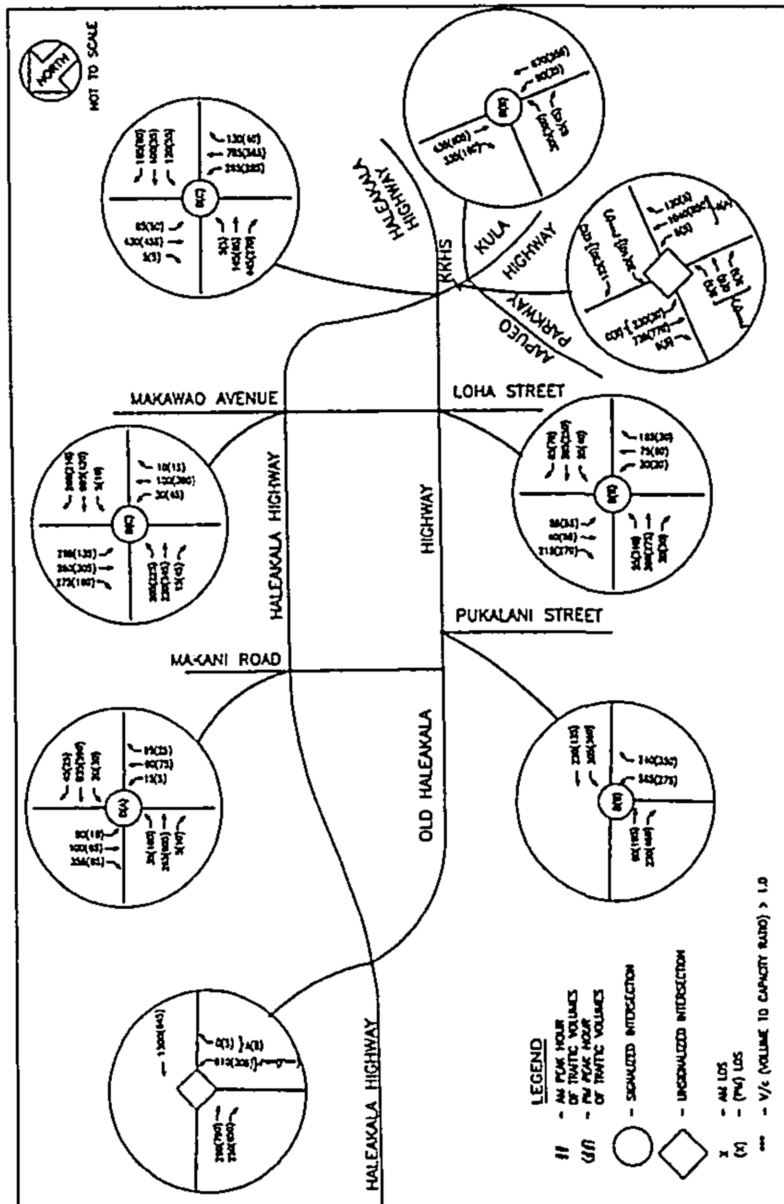
Table 3 (continued)
LOS at Study Intersections
Base Year 2005 Without Project

	Existing		Base Year 2005	
	AM Peak Hour	PM Peak Hour	AM Peak Hour	PM Peak Hour
Old Haleakala Highway/Makawao Avenue/Loha Street				
NB LT/TH/RT	B	B	C	B
SB LT/TH	B	B	B	B
SB RT	C	C	C	C
WB LT/TH/RT	B	B	B	B
EB LT	A	A	A	A
EB TH/RT	A	A	A	A
Overall	B	B	B	B
Kula Highway/KKHS Driveway/Residential Driveway				
NB LT/TH	A	A	A	A
SB LT	B	A	C	B
WB LT	F	E	F*	F
WB RT	C	C	E	C
EB LT/TH/RT	F	E	F*	F
Kula Highway/Aapueo Parkway				
NB LT	A	A	--	--
EB LT	F*	F*	--	--
EB RT	B	B	--	--
Kula Highway/Aapueo Parkway (Signalized)				
NB LT	--	--	A	A
NB TH	--	--	C	B
SB TH	--	--	B	B
SB RT	--	--	A	A
EB LT	--	--	C	B
EB RT	--	--	C	B
Overall	--	--	B	B

*V/c (volume to capacity ratio)>1.0



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BASE YEAR 2005 TRAFFIC VOLUMES
(WITHOUT PROJECT-GENERATED TRAFFIC)

FIGURE 5

C. Base Year 2005 Traffic Mitigation Measures

The following traffic mitigation measures are proposed to accommodate Base Year 2005 projected traffic volumes <u>without</u> Project-generated traffic.

<u>Haleakala Highway/Old Haleakala Highway (Western Intersection)</u>

Install a traffic signal system at this intersection. As mentioned earlier, a review of 24-hour traffic count data collected in 2001 indicates that traffic volumes at this intersection meet the four-hour warrant for the installation of a traffic signal system as described in the <u>MUTCD-2000</u>. Interconnect and synchronize this traffic signal system with the planned traffic signal system at the Haleakala Highway/Makani Road intersection, and existing traffic signal systems along Haleakala Highway at Makawao Avenue and the Five Trees Junction. Table 4 summarizes the Base Year 2005 LOS analysis at the Haleakala Highway/Old Haleakala Highway (Western Intersection) with the installation of a traffic signal system. The intersection will operate overall at LOS F during the AM peak hour of traffic and LOS B during the PM peak hour of traffic. All individual movements will operate at LOS D or better except for northbound left-turn and westbound through traffic, which will operate at LOS F during the AM peak hour of traffic.

The results shown in Table 4 assume a traffic signal system phasing such that the signal will stop all the westbound through traffic on Haleakala Highway and assign the right-of-way to the northbound left-turn traffic on Old Haleakala Highway (i.e. creating a separate phase for each approach). The widening of Haleakala Highway from Hana Highway to the Old Haleakala Highway/Haleakala Highway (Western Intersection) will provide an additional westbound through lane. Haleakala Highway east of Old Haleakala Highway/Haleakala Highway (Western Intersection) as a single lane feed would allow the traffic signal system to only stop eastbound traffic on Haleakala Highway and northbound traffic on Old Haleakala Highway. The northbound left-turn from Old Haleakala Highway would have a dedicated lane west of the intersection. In this case, the westbound through vehicles would not be controlled by the traffic signal system and would be allowed to proceed continuously. This alternate signal phasing would result in the intersection operating overall at LOS A during the AM and PM peak hours of traffic with all individual movements operating at LOS D or better.

Table 4
LOS with Traffic Mitigative Measures
Base Year 2005

	Base Year 2005		Base Year 2005 With Mitigative Measures	
	AM Peak	PM Peak	AM Peak	PM Peak
Haleakala Highway/Old Haleakala Highway (Western Intersection)				
NB LT	F*	F*	--	--
WB TH	A	B	--	--
Haleakala Highway/Old Haleakala Highway (Western Intersection, signalized)				
NB LT	--	--	F*	C
WB TH	--	--	F*	B
EB TH	--	--	B	A
Overall	--	--	F*	B

*V/c (volume to capacity ratio)>1.0

D. **Base Year 2006 Without Project**

The following are descriptions of new/future known developments that are expected to generate significant traffic demand within the study area and anticipated to be completed in Year 2006. Traffic generated by these projects, in addition to traffic generated by the known developments anticipated to be completed by Year 2005, is included in Base Year 2006 traffic projections for this study.

1. **Kulamalu Development**

The Kulamalu Assisted Living/Skilled Nursing Facility, with 102 beds, and the Kulamalu Adult Day Care Center, which is estimated to have approximately 70 clients, are anticipated to be completed in 2006 as part of the Kulamalu development. Also, Phase 3 of the Kulamalu

Commercial Subdivision is anticipated to be completed in 2006 and will consist of office and commercial uses. Peak hour vehicular trips generated by these projects were estimated by applying appropriate trip generation rates in ITE Trip Generation, 6th Edition. It is unknown at this time exactly what type of developments will be constructed within Phase 3 of the Kulamalu Commercial Subdivision. Phase 3 of the Kulamalu Commercial Subdivision was assumed to consist of a mix of 25 percent office and 75 percent retail by floor area (44,260 SF of office space and 132,780 SF of retail space) for the purpose of estimating background traffic for this study.

2. **Upcountry Town Center**

Maui Land and Pineapple Company has proposed to develop the Upcountry Town Center, which will consist of a mix of retail, office, industrial and residential uses, on the triangular parcel of land bordered by Haleakala Highway, Old Haleakala Highway and Makawao Avenue. The Upcountry Town Center is currently anticipated to be completed in Year 2006 based on available information. Peak hour trips generated by the Upcountry Town Center were obtained from the Traffic Impact Assessment for the Upcountry Town Center by Parsons Brinckerhoff Quade & Douglas, dated March 2002.

Table 5 shows the trips generated during the peak hour of traffic by the known developments near the Project that are anticipated to be completed by Year 2006 excluding Project-generated trips. Note that Table 5 includes the known developments that are accounted for in Base Year 2005.

Table 5
Base Year 2006 Peak Hour of Traffic
Trips Generated by the Known Developments Near the Project

	AM Peak		PM Peak	
	Enter	Exit	Enter	Exit
County Park (9.3 Acres)	3	1	2	4
Kulamalu Hilltop Subdivision (12 units)	4	14	10	8
Kulamalu Mauka Subdivision	41	6	75	159
Expansion of Kamehameha Schools Maui Campus (Grades K-12)	218	145	30	45
Kulamalu Skilled Nursing Facility (102 beds)	11	6	8	12
Kulamalu Adult Day Care (70 clients)	82	75	75	82
Phase 3 of the Kulamalu Commercial Subdivision	86	12	170	303
Kula Residence Unit 1 (219 remaining lots)	44	50	53	31
Kualono Subdivision (49 lots)	14	34	38	24
Upcountry Town Center	268	91	377	552
Total	771	434	838	1218

E. Base Year 2006 Traffic Operations Without Project-Generated Traffic

The Base Year 2006 traffic conditions without traffic generated by the IFA are described below. Analysis of Base Year 2006 traffic conditions without the Project indicates traffic at the study intersections will operate at LOS D or better except at the following locations. Table 6 summarizes the Base Year 2006 LOS at the study intersections. Figure 6 shows the Base Year 2006 traffic volumes and LOS at the study intersections during the AM and PM peak hours of traffic. The LOS analysis assumes that drivers behave according to traffic controls and does not account for delays caused by vehicles on Kula Highway yielding to vehicles turning into and out of the KKHS driveway and vehicles turning out of Aapueo Parkway during the AM peak hour of traffic. If drivers continue to behave inconsistently with traffic controls, northbound through vehicles on Kula

Highway will experience LOS F conditions in the vicinity of KKHS and Aapueo Parkway during the 20-minute period before the start of the KKHS school day (8:00 AM).

Haleakala Highway/Old Haleakala Highway (Western Intersection)

With the installation of a traffic signal system, this intersection will operate overall at LOS F during the AM peak hour of traffic and LOS C during the PM peak hour of traffic. The northbound left-turn and westbound through traffic will operate at LOS F during the AM peak hour of traffic.

The results shown in Table 6 assume a traffic signal system phasing such that the signal will stop all the westbound through traffic on Haleakala Highway and assign the right-of-way to the northbound left-turn traffic on Old Haleakala Highway (i.e. creating a separate phase for each approach). The widening of Haleakala Highway from Hana Highway to the Old Haleakala Highway/Haleakala Highway (Western Intersection) will provide an additional westbound through lane. Haleakala Highway east of Old Haleakala Highway/Haleakala Highway (Western Intersection) as a single lane feed would allow the traffic signal system to only stop eastbound traffic on Haleakala Highway and northbound traffic on Old Haleakala Highway. The northbound left-turn from Old Haleakala Highway would have a dedicated lane west of the intersection. In this case, the westbound through vehicles would not be controlled by the traffic signal system and would be allowed to proceed continuously. This alternate signal phasing would result in the intersection operating overall at LOS B during the AM and PM peak hours of traffic with all individual movements operating at LOS D or better.

Haleakala Highway/Makani Road

With the installation of a traffic signal system, this intersection will operate overall at LOS D during the AM peak hour of traffic and LOS B during the PM peak hour of traffic. The southbound right-turn will operate at LOS E during the AM peak hour of traffic.

Haleakala Highway/Makawao Avenue

This signalized intersection will operate overall at LOS E during the AM peak hour of traffic and LOS F during the PM peak hour of traffic. Northbound through traffic will operate at LOS E during the PM peak hour of traffic. Southbound through traffic will operate at LOS E during the AM peak hour of traffic. The southbound left-turn, westbound left-turn, and eastbound left-turn will operate at LOS F during the AM and PM peak hours of traffic. Westbound through traffic will operate at LOS E during the AM and PM peak hours of traffic.

Haleakala Highway/Kula Highway/Old Haleakala Highway (Five Trees Junction)

This signalized intersection will operate overall at LOS D during the AM and PM peak hours of traffic. The northbound left-turn will operate at LOS E during the AM and PM peak hours of traffic. The southbound left-turn will operate at LOS E during the PM peak hour of traffic. Traffic in the westbound shared left-turn/through lane will operate at LOS E during the AM peak hour of traffic.

Kula Highway/KKHS Driveway/Residential Driveway

Westbound left-turn traffic from KKHS will operate at LOS F during the AM and PM peak hours of traffic. Westbound right-turn traffic from KKHS will operate at LOS E during the AM peak hour of traffic. Eastbound traffic on the shared driveway approach will operate at LOS F during the AM and PM peak hours of traffic. However, few vehicles are projected to use the shared driveway approach, ten (10) vehicles during the AM peak hour of traffic and ten (10) vehicles during the PM peak hour of traffic. The projected Base Year 2006 traffic volumes at this intersection during the AM and PM peak hours of traffic do not meet the peak hour warrant for the installation of a traffic signal system as described in the MUTCD-2000.

Kula Highway/Aapueo Parkway

With the installation of a traffic signal system, this intersection will operate overall at LOS C during the AM and PM peak hours of traffic. The northbound left-turn will operate at LOS E during the PM peak hour of traffic.

Table 6
LOS at Study Intersections
Base Year 2006 Without Project

	Existing		Base Year 2006	
	AM Peak Hour	PM Peak Hour	AM Peak Hour	PM Peak Hour
Haleakala Highway/Old Haleakala Highway (Western Intersection)				
NB LT	--	F	--	--
NB RT	--	B	--	--
Haleakala Highway/Old Haleakala Highway (Western Intersection, Signalized)				
NB LT	--	--	F*	C
WB TH	--	--	F*	C
EB TH	--	--	B	B
Overall	--	--	F*	C
Haleakala Highway/Makani Road				
NB LT/TH	E	F*	--	--
NB RT	A	B	--	--
SB LT/TH	F*	F*	--	--
SB RT	F*	B	--	--
WB LT	A	A	--	--
EB LT	A	A	--	--

*V/c (volume to capacity ratio) > 1.0

Table 6 (continued)
LOS at Study Intersections
Base Year 2006 Without Project

	Existing		Base Year 2006	
	AM Peak Hour	PM Peak Hour	AM Peak Hour	PM Peak Hour
Haleakala Highway/ Makani Road (signalized)				
NB LT/TH	--	--	C	C
NB RT	--	--	C	C
SB LT/TH	--	--	C	C
SB RT	--	--	E	C
WB LT	--	--	A	A
WB TH/RT	--	--	D	B
EB LT	--	--	B	C
EB TH/RT	--	--	A	A
Overall	--	--	D	B
Haleakala Highway/Makawao Avenue				
NB LT	B	B	D	D
NB TH	B	C	D	E
NB RT	B	A	D	C
SB LT	D	D	F	F*
SB TH	B	B	E	D
SB RT	B	A	C	C
WB LT	C	C	F	F
WB TH	C	C	E	E
WB RT	B	C	D	D
EB LT	D	C	F	F
EB TH	B	B	C	C
EB RT	B	B	C	C
Overall	C	C	E	F

*V/c (volume to capacity ratio) > 1.0

Table 6 (continued)
LOS at Study Intersections
Base Year 2006 Without Project

	Existing		Base Year 2006	
	AM Peak Hour	PM Peak Hour	AM Peak Hour	PM Peak Hour
Haleakala Highway/Kula Highway/Old Haleakala Highway (Five Trees Junction)				
NB LT	C	C	E	E
NB TH	C	B	D	B
SB LT	C	C	D	E
SB TH	B	B	D	D
SB RT	B	B	C	B
WB LT/TH	C	C	E	D
EB LT/TH	C	C	C	D
Overall	C	B	D	D
Old Haleakala Highway/Pukalani Street				
NB LT	C	B	C	C
NB RT	A	B	A	C
WB LT	C	B	C	D
WB TH	B	A	B	A
EB TH	C	B	C	B
EB RT	A	A	A	A
Overall	C	B	B	C
Old Haleakala Highway/Makawao Avenue/Loha Street				
NB LT/TH/RT	B	B	C	B
SB LT/TH	B	B	B	B
SB RT	C	C	C	D
WB LT/TH/RT	B	B	C	C
EB LT	A	A	A	A
EB TH/RT	A	A	A	A
Overall	B	B	B	C

*V/c (volume to capacity ratio) > 1.0

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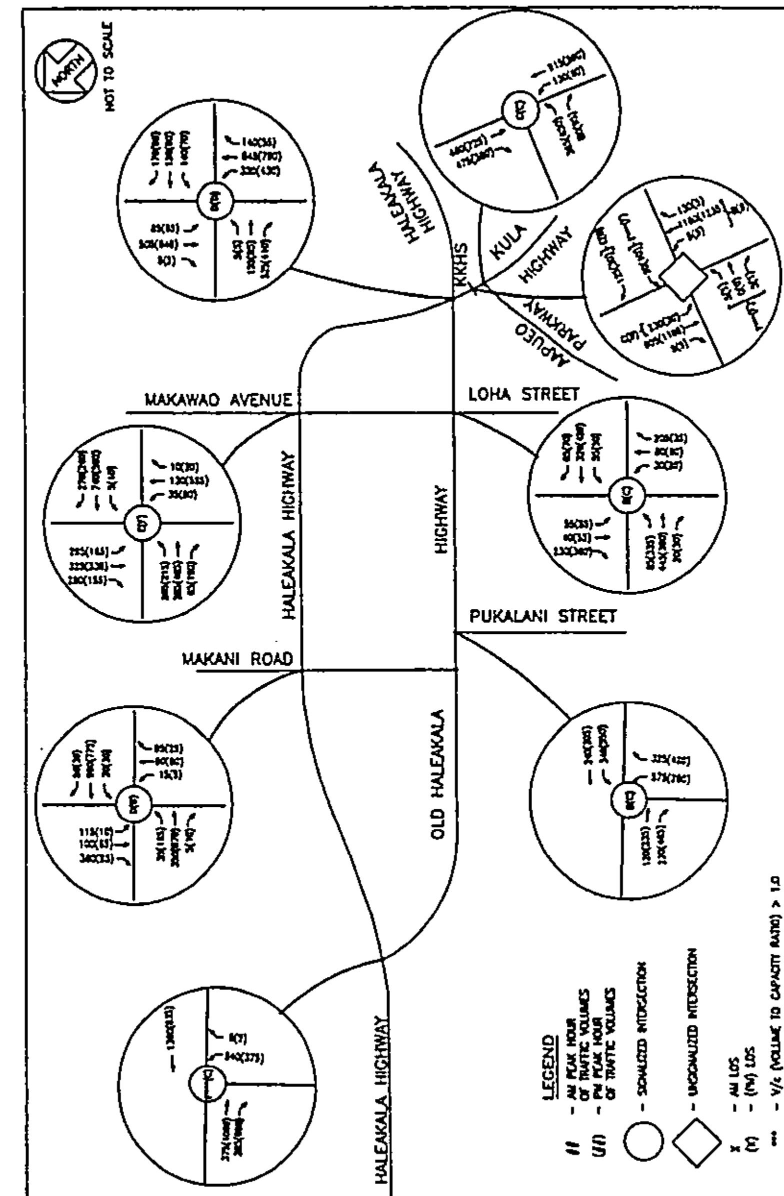
Table 6 (continued)
LOS at Study Intersections
Base Year 2006 Without Project

	Existing		Base Year 2006	
	AM Peak Hour	PM Peak Hour	AM Peak Hour	PM Peak Hour
Kula Highway/KKHS Driveway/Residential Driveway				
NB LT/TH	A	A	B	B
SB LT	B	A	C	B
WB LT	F	E	F*	F
WB RT	C	C	E	D
EB LT/TH/RT	F	E	F*	F
Kula Highway/Aapueo Parkway				
NB LT	A	A	--	--
EB LT	F*	F*	--	--
EB RT	B	B	--	--
Kula Highway/Aapueo Parkway (signalized)				
NB LT	--	--	B	E
NB TH	--	--	C	C
SB TH	--	--	B	D
SB RT	--	--	A	A
EB LT	--	--	D	D
EB RT	--	--	C	B
Overall	--	--	C	C

*V/c (volume to capacity ratio) > 1.0



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BASE YEAR 2006 TRAFFIC VOLUMES
(WITHOUT PROJECT-GENERATED TRAFFIC)

FIGURE 6

F. Base Year 2006 Traffic Mitigation Measures

The following traffic mitigation measures are proposed to accommodate Base Year 2006 projected traffic volumes without Project-generated traffic. Table 7 summarizes the Base Year 2006 LOS analysis with traffic mitigation measures for the affected intersections.

Haleakala Highway

Widen Haleakala Highway to four (4) lanes, two (2) lanes in each direction, from the Haleakala Highway/Old Haleakala Highway (Western Intersection) to west of the Five Trees Junction. Together with the planned widening by SDOT, Haleakala Highway would provide four (4) lanes from Hana Highway to west of the Five Trees Junction. An additional westbound lane could be provided to begin at approximately the same location where currently two (2) Haleakala Highway eastbound lanes narrow to one (1) lane just west of the Five Trees Junction. With widening of Haleakala Highway as described, the Haleakala Highway/Old Haleakala Highway (Western Intersection) will operate overall at LOS E during the AM peak hour of traffic and LOS B during the PM peak hour of traffic. All individual movements at the Haleakala Highway/Old Haleakala Highway (Western Intersection) will operate at LOS D or better except for the northbound left-turn and westbound through traffic, which will operate at LOS E and LOS F, respectively during the AM peak hour of traffic. The Haleakala Highway/Makani Road intersection will operate overall at LOS C during the AM peak hour of traffic and LOS A during the PM peak hour of traffic with all individual movements operating at LOS D or better.

The results shown in Table 7 assume a traffic signal system phasing such that the signal will stop all the westbound through traffic on Haleakala Highway and assign the right-of-way to the northbound left-turn traffic on Old Haleakala Highway (i.e. creating a separate phase for each approach). It may be possible to allow these movements to proceed through the intersection simultaneously if an acceleration lane is provided to receive the northbound left-turning vehicles. In this case, vehicles turning left from northbound Old Haleakala Highway onto westbound Haleakala Highway would merge with traffic on Haleakala Highway

further west of the intersection. The westbound through vehicles would not be controlled by the traffic signal system and would be allowed to proceed continuously. This alternate signal phasing would result in the Haleakala Highway/Old Haleakala Highway (Western Intersection) operating overall at LOS A during the AM and PM peak hours of traffic with all individual movements operating at LOS D or better. The merging of vehicles turning left onto Haleakala Highway with westbound through vehicles on Haleakala Highway will operate at LOS C during the AM peak hour of traffic and LOS B during the PM peak hour of traffic.

Haleakala Highway/Makawao Avenue

Modify the traffic signal system at the Haleakala Highway/ Makawao Avenue intersection to provide a protected left-turn phase to serve left-turns from Makawao Avenue. Due to the high volume of northbound through vehicles (555 vehicles) during the PM peak hour of traffic, a protected left-turn phase would be beneficial for traffic on the Makawao Avenue approaches. With a protected left-turn phase for the minor street approaches and proposed widening of Haleakala Highway as previously described, the intersection will operate overall at LOS C during the AM peak hour of traffic and LOS D during the PM peak hour of traffic. All individual movements will operate at LOS D or better except for the northbound, southbound, westbound and eastbound left-turn, and northbound and westbound through traffic, which will operate at LOS E during the PM peak hour of traffic.

Haleakala Highway/Kula Highway/Old Haleakala Highway (Five Trees Junction)

Adjust the traffic signal system timing at the Five Trees Junction intersection to be coordinated with the modified traffic signal at the Haleakala Highway/Makawao Avenue intersection. Due to the high volume of northbound through vehicles (555 vehicles) during the PM peak hour of traffic, a protected left-turn phase would be beneficial for traffic on the Makawao Avenue approaches. LOS analysis indicates that with adjustment of the traffic signal timing, traffic at the Five Trees Junction will operate similar to Base Year 2006 conditions.

Table 7
LOS with Traffic Mitigative Measures
Base Year 2006

	Base Year 2006		Base Year 2006 With mitigative measures	
	AM Peak	PM Peak	AM Peak	PM Peak
Haleakala Highway/Old Haleakala Highway (Western Intersection, signalized)				
NB LT	F*	C	E*	B
WB TH	F*	C	F*	B
EB TH	B	B	C	B
Overall	F*	C	E	B
Haleakala Highway/Makani Road (signalized)				
NB LT/TH	C	C	B	C
NB RT	C	C	B	C
SB LT/TH	C	C	B	C
SB RT	E	C	C	C
WB LT	A	A	B	A
WB TH/RT	D	B	C	A
EB LT	B	C	B	A
EB TH/RT	A	A	B	A
Overall	D	B	C	A
Haleakala Highway/Makawao Avenue				
NB LT	D	D	D	E
NB TH	D	E	D	E
NB RT	D	C	C	B
SB LT	F	F*	D	E
SB TH	E	D	C	C
SB RT	C	C	B	B
WB LT	F	F	D	E
WB TH	E	E	D	E
WB RT	D	D	B	D
EB LT	F	F	D	E
EB TH	C	C	C	D
EB RT	C	C	B	C
Overall	E	F	C	D

*V/c (volume to capacity ratio) > 1.0

IV. FUTURE TRAFFIC CONDITIONS WITH PROJECT

A. Trip Generation

Phase 1

Although Trip Generation, 6th Edition contains trip rates for a "Research and Development Center", it is described as an 8:00 AM to 5:00 PM work facility. Since the IFA Walakoa Laboratory functions more as a base station/support center rather than a 8:00 AM to 5:00 PM work facility, traffic generated by the Phase 1 ATC was estimated based on current operations at the IFA Walakoa Laboratory facility.

Phase 1 development will be primarily a relocation and expansion of the existing IFA Walakoa Laboratory facility operations based on discussions with IFA staff. The Phase 1 ATC will house approximately 30 employees, thus, the current operation with 20 employees was assumed to increase proportionally by 50 percent to represent this expansion as the exact breakdown of the additional personnel positions are not known at this time. Table 8 shows the projected increases in personnel and State-owned vehicles.

The trip generation estimate is based on the following travel characteristics. These projections were made to provide a conservative trip generation estimate for purpose of evaluating a reasonable worst-case scenario in the traffic analysis. In reality, all of the flex-time staff and the afternoon research staff may enter and exit at times outside of the AM and PM commuter peak hours of traffic since the start and end of the workdays are influenced by viewing conditions at the summit which may result in workdays exceeding eight hours. Table 9 shows the trip generation estimate for Phase 1, which is based on the following.

AM Peak Hour of Traffic

- All of the 8:00 AM to 5:00 PM staff enters during the AM peak hour of traffic.
- All of the flex-time staff enters during the AM peak hour of traffic.
- Ten (10) vehicles travel to the summit during the AM peak hour of traffic as a result of the flex-time staff.

PM Peak Hour of Traffic

- All of the 8:00 AM to 5:00 PM staff leaves after 5:00 PM and are not included in the PM peak hour projections.
- All of the afternoon staff enters during the PM peak hour of traffic.
- Five (5) vehicles travel to the summit during the PM peak hour of traffic as a result of the afternoon research staff.
- Half of the vehicles (five (5)) return from the summit for the flex-time staff; this flex time staff (five (5) persons) then leaves for home during the PM peak hour of traffic.

Table 8
Projected Operations for Phase 1

	20-Employee Operation	30-Employee Operation
Vehicles	10	15
8:00 AM – 5:00 PM staff	6	9
Afternoon Research Staff	6	9
Flex-Time Staff	8	12

Table 9
Peak Hour Trip Generation for Phase 1

	AM Peak Hour of Traffic		PM Peak Hour of Traffic	
	Enter	Exit	Enter	Exit
8:00 AM – 5:00 PM Staff	9	0	0	0
Afternoon Research Staff	0	0	9	5
Flex-Time Staff	12	10	5	5
Total	21	10	14	10

Phase 2

Traffic generated by the 44,028 gross square footage of the Phase 2 ATRC buildings was estimated by applying trip generation trip rates and equations for a research and development center as described in Trip Generation, 6th Edition. The exact breakdown of the Phase 2 staff and/or building spaces have not been specifically defined at the time of this report.

Table 10 shows the trip rates used and Table 11 shows the peak hour trips generated by Phase 2. Table 12 summarizes the total trips generated for the Project.

Table 10
Trip Generation Equations and Rates for Phase 2

	Average Weekday Daily Trip Rate	AM Peak Hour of Traffic		PM Peak Hour of Traffic	
		Trip Rate	% Enter	Trip Rate	% Enter
Research and Development Center (ITE Code 760) Per 1,000 SF GFA	11.82	1.50	83	1.52	15

Table 11
Peak Hour Trip Generation for Phase 2

	Average Weekday (vpd)	AM Peak Hour of Traffic (vph)		PM Peak Hour of Traffic (vph)	
		Enter	Exit	Enter	Exit
Research and Development Center (44,028 SF)	520	55	11	10	57

Table 12
Peak Hour Trip Generation for Phase 1 and Phase 2

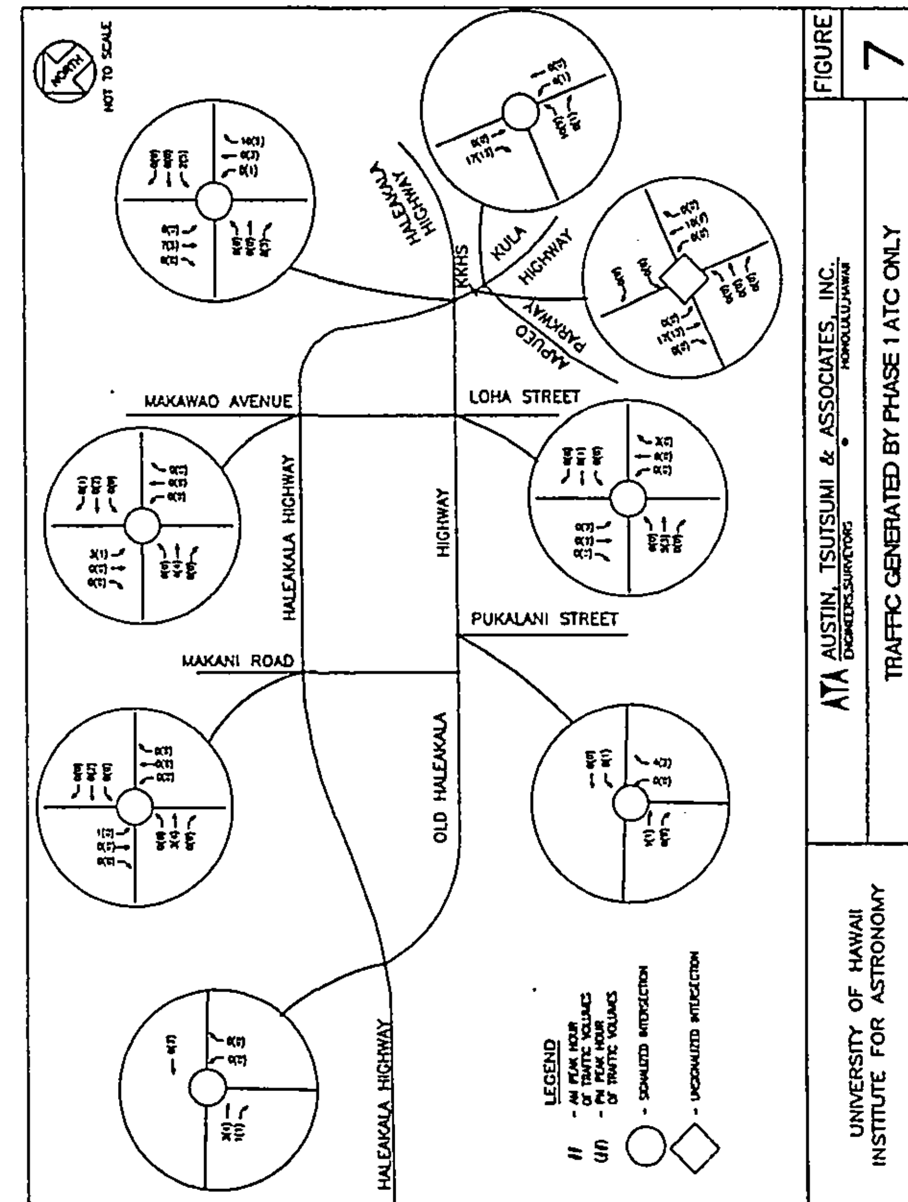
	AM Peak Hour of Traffic (vph)		PM Peak Hour of Traffic (vph)	
	Enter	Exit	Enter	Exit
Phase I (ATC)	21	10	14	10
Phase II (ATRC)	55	11	10	57
Total	**76**	**21**	**24**	**67**

B. Project and Roadway Access

A single driveway on the future Ohia Ku Street will provide vehicular access to the Project. Ohia Ku Street will intersect Aapueo Parkway forming an unsignalized "Tee"-intersection. The Ohia Ku Street approach will be the stop sign-controlled stem at this intersection.

C. Traffic Distribution and Assignment

Trips to and from the summit (ten (10) vehicles exiting during the AM peak hour of traffic, five (5) vehicles entering during the PM peak hour of traffic, and five (5) vehicles exiting during the PM peak hour of traffic) were assigned to the route using the Haleakala Highway/Kula Highway/Old Haleakala Highway intersection. Existing traffic patterns were used to distribute ATC and ATRC home-based work trips. Figure 7 shows the traffic assignment for Phase 1 and Figure 8 shows the total traffic assignment for the Project.



CORRECTION

THE PRECEDING DOCUMENT(S) HAS BEEN REPHOTOGRAPHED TO ASSURE LEGIBILITY
SEE FRAME(S)
IMMEDIATELY FOLLOWING

Table 12
Peak Hour Trip Generation for Phase 1 and Phase 2

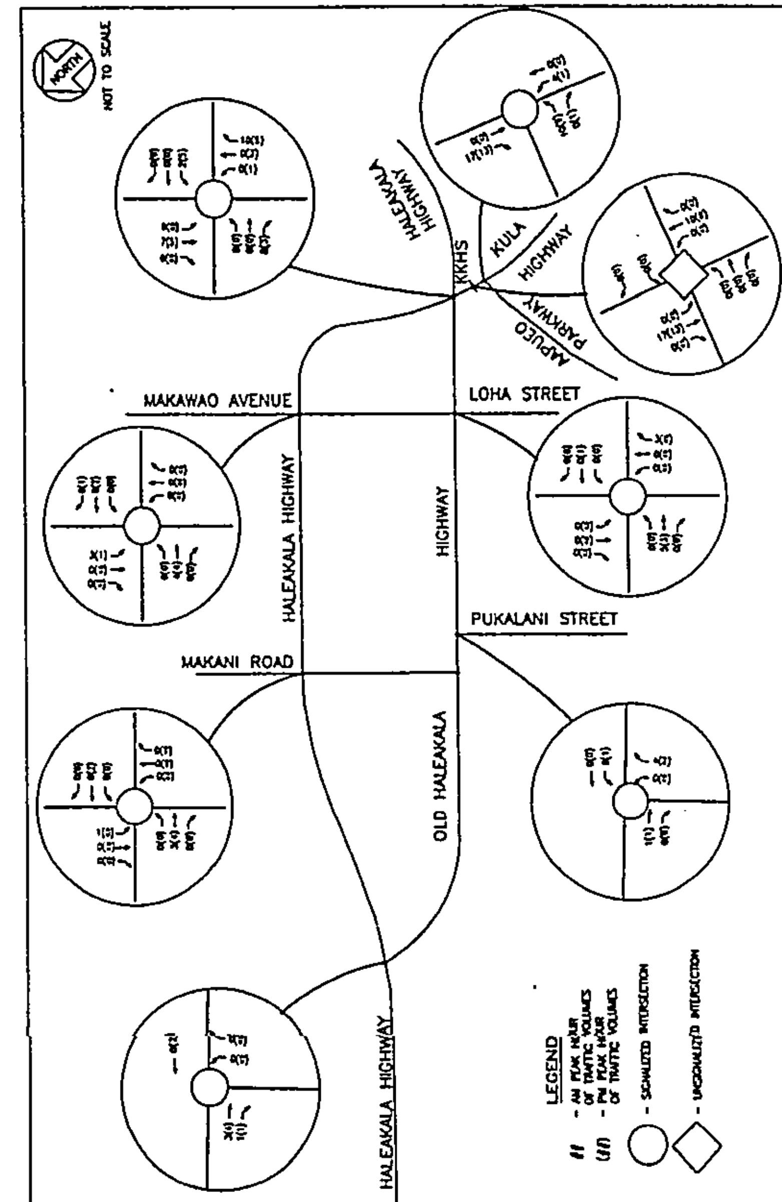
	AM Peak Hour of Traffic (vph)		PM Peak Hour of Traffic (vph)	
	Enter	Exit	Enter	Exit
Phase I (ATC)	21	10	14	10
Phase II (ATRC)	55	11	10	57
Total	76	21	24	67

B. Project and Roadway Access

A single driveway on the future Ohia Ku Street will provide vehicular access to the Project. Ohia Ku Street will intersect Aapueo Parkway forming an unsignalized "Tee"-intersection. The Ohia Ku Street approach will be the stop sign-controlled stem at this intersection.

C. Traffic Distribution and Assignment

Trips to and from the summit (ten (10) vehicles exiting during the AM peak hour of traffic, five (5) vehicles entering during the PM peak hour of traffic, and five (5) vehicles exiting during the PM peak hour of traffic) were assigned to the route using the Haleakala Highway/Kula Highway/Old Haleakala Highway intersection. Existing traffic patterns were used to distribute ATC and ATRC home-based work trips. Figure 7 shows the traffic assignment for Phase 1 and Figure 8 shows the total traffic assignment for the Project.



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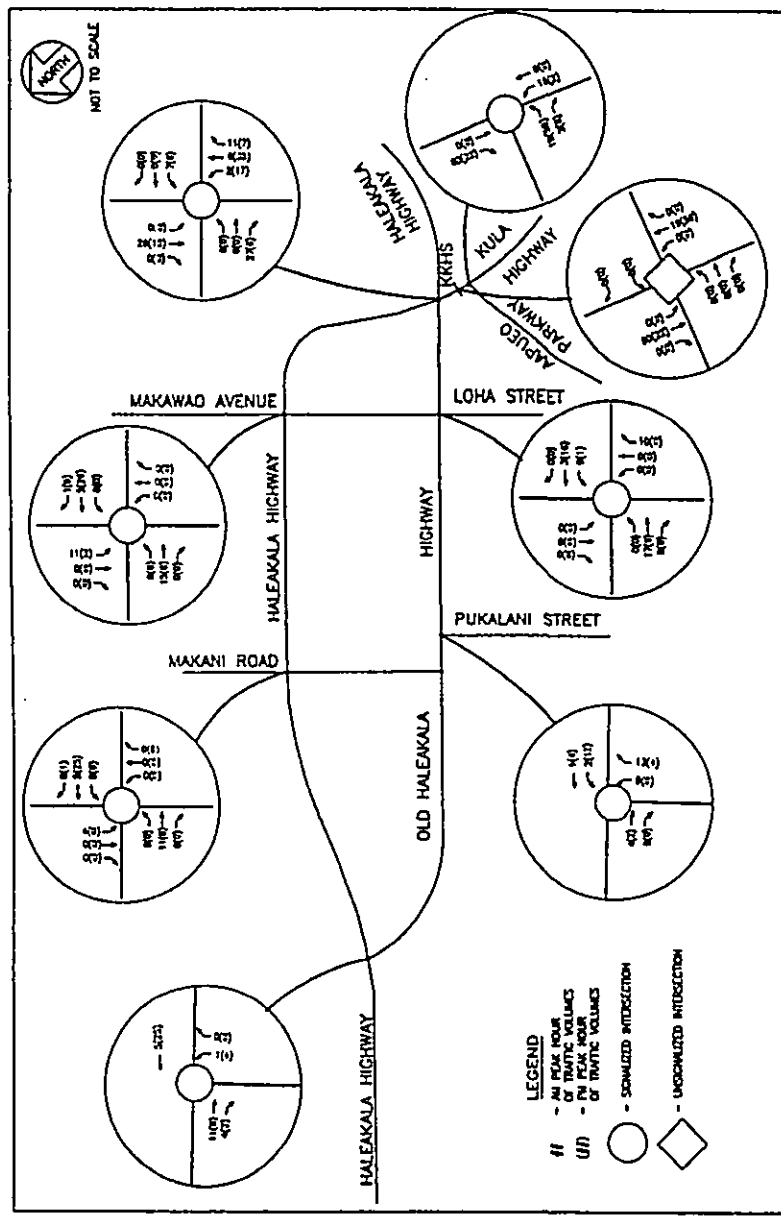
TRAFFIC GENERATED BY PHASE 1 ATC ONLY

FIGURE 7



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TRAFFIC GENERATED BY PHASE 1 ATC AND PHASE 2 ATRC

FIGURE 8

IV. TRAFFIC ANALYSIS WITH PROJECT

A. Year 2005 with Phase 1

Traffic generated by Phase 1 of the Project was added to Base Year 2005 traffic volumes to estimate Year 2005 traffic volumes with the Project. Analysis of Year 2005 traffic conditions with the Project indicates that traffic will operate similar to Base Year 2005 conditions. With the installation of traffic signal systems at the Haleakala Highway/Old Haleakala Highway, Haleakala Highway/Makani Road and Kula Highway/Aapueo Parkway intersections, traffic at the study intersections will operate at LOS D or better except at the following locations. Table 13 summarizes the Year 2006 LOS with Phase 1 at the study intersections. Figure 9 shows the Year 2006 traffic volumes and LOS with Phase 1 at the study intersections during the AM and PM peak hours of traffic. As previously discussed, the LOS analysis assumes that drivers behave according to traffic controls and does not account for delays caused by vehicles on Kula Highway yielding to vehicles turning into and out of the KKHS driveway and vehicles turning out of Aapueo Parkway during the AM peak hour of traffic. If drivers continue to behave inconsistently with traffic controls, northbound through vehicles on Kula Highway will experience LOS F conditions in the vicinity of KKHS and Aapueo Parkway during the 20-minute period before the start of the KKHS school day (8:00 AM).

<u>Haleakala Highway/Old Haleakala Highway (Western Intersection)</u>

With the installation of a traffic signal system, the intersection will operate overall at LOS F during the AM peak hour of traffic and LOS B during the PM peak hour of traffic. Northbound left-turn and westbound through traffic which will operate at LOS F during the AM peak hour of traffic.

The results shown in Table 13 assume a traffic signal system phasing such that signal will stop all the westbound through traffic on Haleakala Highway and assign the right-of-way to the northbound left-turn traffic on Old Haleakala Highway (i.e. creating a separate phase for each approach). The widening of Haleakala Highway from Hana Highway to the Old Haleakala Highway/Haleakala Highway (Western Intersection) will provide an additional westbound through lane. Haleakala Highway east of Old Haleakala Highway/Haleakala Highway (Western Intersection) as a single lane feed would allow the traffic signal system to only stop eastbound traffic on Haleakala Highway and northbound traffic on Old Haleakala Highway. The northbound left-turn from Old Haleakala Highway would have a dedicated lane west of the intersection. Using this alternate signal phasing will result in the intersection operating overall at LOS A during the AM and PM peak hours of traffic with all individual movements operating at LOS D or better.

Haleakala Highway/Makawao Avenue

This signalized intersection will operate overall at LOS D during the AM peak hour of traffic and LOS C during the PM peak hour of traffic. The southbound left-turn and eastbound left-turn will operate at LOS E during the AM peak hour of traffic.

Kula Highway/KKHS Driveway/Residential Driveway

The westbound left-turn from KKHS will operate at LOS F during the AM and PM peak hours of traffic. The westbound right-turn from KKHS will operate at LOS E during the AM peak hour of traffic. Eastbound traffic on the shared driveway approach will operate at LOS F during the AM and PM peak hours of traffic. However, few vehicles are projected to use the shared driveway approach, ten (10) vehicles during the AM peak hour of traffic and ten (10) vehicles during the PM peak hour of traffic. The projected Year 2005 with Phase 1 traffic volumes at this intersection during the AM and PM peak hours of traffic do not meet the peak hour warrant for the installation of a traffic signal system as described in the MUTCD-2000.

Table 13
LOS at Study Intersections
Year 2005 with Phase 1

	Existing		Base Year 2005 with Mitigative Measures		Year 2005 with Phase 1	
	AM Peak Hour	PM Peak Hour	AM Peak Hour	PM Peak Hour	AM Peak Hour	PM Peak Hour
Haleakala Highway/Old Haleakala Highway (Western Intersection)						
NB LT	--	F	--	--	--	--
NB RT	--	B	--	--	--	--
Haleakala Highway/Old Haleakala Highway (Western Intersection, signalized)						
NB LT	--	--	F*	C	F*	C
WB TH	--	--	F*	B	F*	B
EB TH	--	--	B	A	B	A
Overall	--	--	F*	B	F*	B
Haleakala Highway/Makani Road						
NB LT/TH	E	F*	--	--	--	--
NB RT	A	B	--	--	--	--
SB LT/TH	F*	F*	--	--	--	--
SB RT	F*	B	--	--	--	--
WB LT	A	A	--	--	--	--
EB LT	A	A	--	--	--	--
Haleakala Highway/Makani Road (signalized)						
NB LT/TH	--	--	C	C	C	C
NB RT	--	--	C	C	C	C
SB LT/TH	--	--	C	C	C	C
SB RT	--	--	D	C	D	C
WB LT	--	--	B	A	B	A
WB TH/RT	--	--	D	A	D	A
EB LT	--	--	B	A	B	B
EB TH/RT	--	--	A	A	B	A
Overall	--	--	D	A	D	B

*V/c (volume to capacity ratio) > 1.0

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Table 13 (continued)
LOS at Study Intersections
Year 2005 with Phase 1

	Existing		Base Year 2005 with Mitigative Measures		Year 2005 with Phase 1	
	AM Peak Hour	PM Peak Hour	AM Peak Hour	PM Peak Hour	AM Peak Hour	PM Peak Hour
Haleakala Highway/Makawao Avenue						
NB LT	B	B	C	B	C	B
NB TH	B	C	C	C	C	C
NB RT	B	A	B	A	B	A
SB LT	D	D	E	D	E	D
SB TH	B	B	C	B	C	B
SB RT	B	A	B	A	B	A
WB LT	C	C	D	C	D	C
WB TH	C	C	D	D	D	D
WB RT	B	C	C	C	C	C
EB LT	D	C	E	D	E	D
EB TH	B	B	B	B	B	B
EB RT	B	B	B	B	B	B
Overall	C	C	D	C	D	C
Haleakala Highway/Kula Highway/Old Haleakala Highway (Five Trees Junction)						
NB LT	C	C	D	C	D	C
NB TH	C	B	D	B	D	B
SB LT	C	C	D	C	D	C
SB TH	B	B	C	C	C	C
SB RT	B	B	B	B	B	B
WB LT/TH	C	C	D	C	D	C
EB LT/TH	C	C	C	C	C	C
Overall	C	B	D	C	D	C
Old Haleakala Highway/Pukalani Street						
NB LT	C	B	B	B	B	B
NB RT	A	B	A	B	A	B
WB LT	C	B	C	B	C	B
WB TH	B	A	B	A	B	A
EB TH	C	B	C	B	C	B
EB RT	A	A	A	A	A	A
Overall	C	B	B	B	B	B

*V/c (volume to capacity ratio) > 1.0

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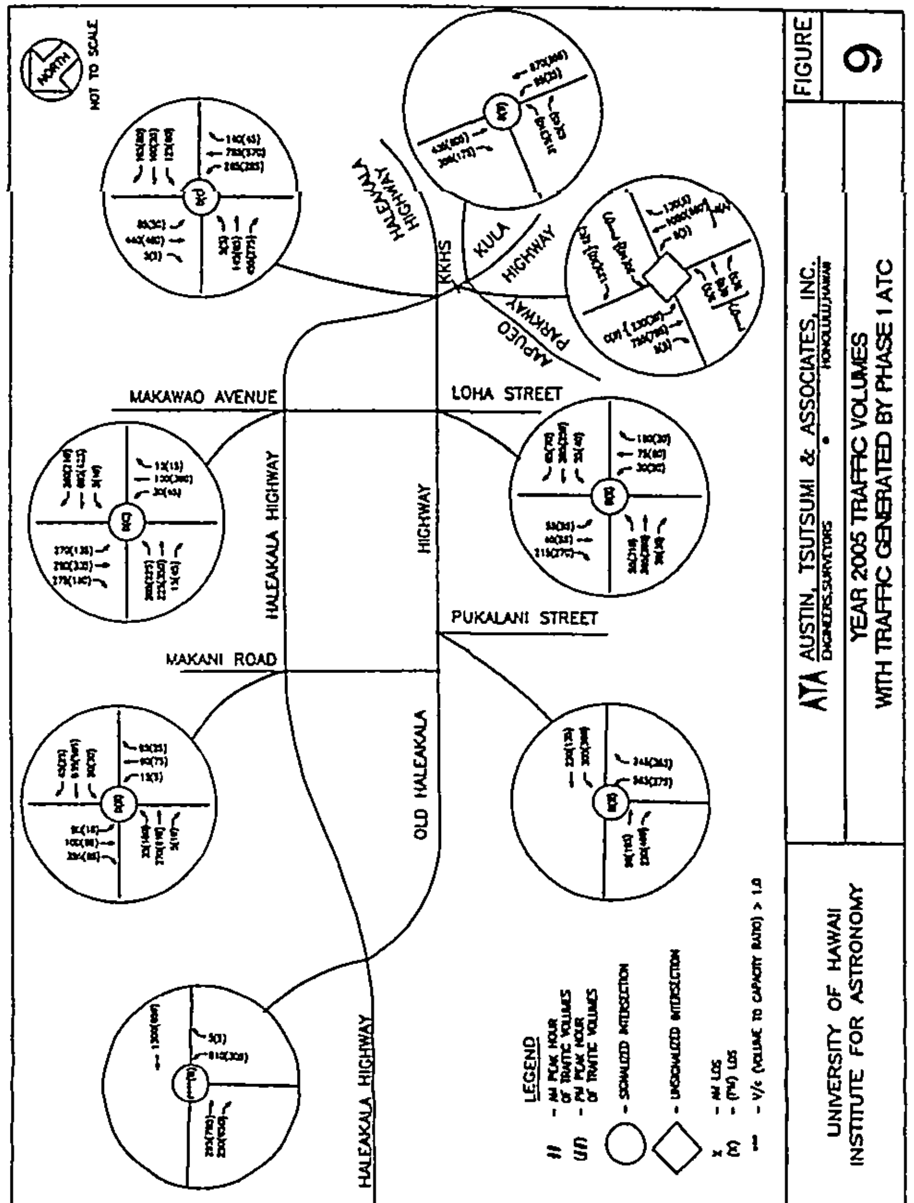
Table 13 (continued)
LOS at Study Intersections
Year 2005 with Phase 1

	Existing		Base Year 2005 with Mitigative Measures		Year 2005 with Phase 1	
	AM Peak Hour	PM Peak Hour	AM Peak Hour	PM Peak Hour	AM Peak Hour	PM Peak Hour
Old Haleakala Highway/Makawao Avenue/Loha Street						
NB LT/TH/RT	B	B	C	B	C	B
SB LT/TH	B	B	B	B	B	B
SB RT	C	C	C	C	C	C
WB LT/TH/RT	B	B	B	B	B	B
EB LT	A	A	A	A	A	A
EB TH/RT	A	A	A	A	A	A
Overall	B	B	B	B	B	B
Kula Highway/KKHS Driveway/Residential Driveway						
NB LT/TH	A	A	A	A	A	A
SB LT	B	A	C	B	C	B
WB LT	F	E	F*	F	F*	F
WB RT	C	C	E	C	E	C
EB LT/TH/RT	F	E	F*	F	F*	F
Kula Highway/Aapueo Parkway						
NB LT	A	A	--	--	--	--
EB LT	F*	F*	--	--	--	--
EB RT	B	B	--	--	--	--
Kula Highway/Aapueo Parkway (signalized)						
NB LT	--	--	A	A	A	A
NB TH	--	--	C	B	C	B
SB TH	--	--	B	B	B	B
SB RT	--	--	A	A	A	A
EB LT	--	--	C	B	C	B
EB RT	--	--	C	B	C	B
Overall	--	--	B	B	B	B

*V/c (volume to capacity ratio) > 1.0



B. **Year 2006 with Phase 1 and Phase 2**

Traffic generated by Phase 1 and Phase 2 of the Project was added to the Base Year 2006 traffic volumes to estimate the Year 2006 traffic volumes with the Project. Analysis of the Year 2006 traffic conditions with the Project indicates that traffic will operate similar to Base Year 2006 conditions. With implementation of Base Year 2005 and Base Year 2006 mitigative measures, traffic at the study intersections will operate at LOS D or better except at the following locations. Table 14 summarizes the Year 2006 LOS with Phase 1 and Phase 2 at the study intersections. Figure 10 shows the Year 2006 traffic volumes and LOS with Phase 1 and Phase 2 at the study intersections during the AM and PM peak hours of traffic. The LOS analysis assumes that drivers behave according to traffic controls and does not account for delays caused by vehicles on Kula Highway yielding to vehicles turning into and out of the KKHS driveway and vehicles turning out of Aapueo Parkway during the AM peak hour of traffic. If drivers continue to behave inconsistently with traffic controls, northbound through vehicles on Kula Highway will experience LOS F conditions in the vicinity of KKHS and Aapueo Parkway during the 20-minute period before the start of the KKHS school day (8:00 AM).

Haleakala Highway/Old Haleakala Highway (Western Intersection)

With the installation of a traffic signal system and widening of Haleakala Highway, the intersection will operate overall at LOS E during the AM peak hour of traffic and LOS B during the PM peak hour of traffic. Northbound left-turn traffic will operate at LOS E and westbound through traffic will operate at LOS F during the AM peak hour of traffic. The results shown in Table 14 assume a traffic signal system phasing such that the signal will stop all the westbound through traffic on Haleakala Highway and assign the right-of-way to the northbound left-turn traffic on Old Haleakala Highway (i.e. creating a separate phase for each approach). Using an alternate signal phasing that would allow these two movements to proceed through the intersection simultaneously, which will require provision of an acceleration lane on Haleakala Highway to receive northbound left-turns, will result in the intersection operating overall at LOS A during the AM and PM peak hours of traffic with all individual movements operating at LOS D or better. The merging of northbound vehicles turning left onto Haleakala Highway with westbound through vehicles on Haleakala Highway will operate at LOS C during the AM peak hour of traffic and LOS B during the PM peak hour of traffic.

Haleakala Highway/Makawao Avenue

With a protected left-turn phase for the minor street approaches and widening of Haleakala Highway, the intersection will operate overall at LOS C during the AM peak hour of traffic and LOS D during the PM peak hour of traffic. The northbound, southbound, westbound and eastbound left-turn, and northbound and westbound through traffic will continue to operate at LOS E during the PM peak hour of traffic.

Kula Highway/KKHS Driveway/Residential Driveway

The westbound left-turn from KKHS will operate at LOS F during the AM and PM peak hour of traffic. The westbound right-turn from KKHS will operate at LOS F during the AM peak hour of traffic. Eastbound traffic on the shared driveway approach will operate at LOS F during the AM and PM peak hours of traffic. However, few vehicles are projected to use the shared driveway approach, ten (10) vehicles during the AM peak hour of traffic and ten (10) vehicles during the PM peak hour of traffic. The projected Year 2006 with Phase 1 and Phase 2 traffic volumes at this intersection during the AM and PM peak hours of traffic do not meet the peak hour warrant for the installation of a traffic signal system as described in the MUTCD-2000.

Haleakala Highway/Kula Highway/Old Haleakala Highway (Five Trees Junction)

This signalized intersection will operate overall at LOS D during the AM and PM peak hours of traffic. The northbound left-turn, southbound left-turn and traffic in the westbound shared left-turn/through lane will operate at LOS E during the AM and PM peak hours of traffic. Southbound through traffic will operate at LOS E during the PM peak hour of traffic.

Kula Highway/Aapueo Parkway

With the installation of a traffic signal system, this intersection will operate overall at LOS C during the AM peak hour of traffic and LOS D

during the PM peak hour of traffic. The northbound left-turn will operate at LOS E during the PM peak hour of traffic. During the PM peak hour of traffic, this intersection will be operating near capacity. Any additional traffic at this intersection other than what is projected for Year 2006 with the Project may require eastbound double left-turn lanes on Aapueo Parkway. This would also require widening of Kula Highway to receive traffic from the double left-turn lanes on Aapueo Parkway.

Table 14
LOS at Study Intersections
Year 2006 With Phase 1 and Phase 2

	Existing		Base Year 2006 with Mitigative Measures		Year 2006 with Phase 1 & Phase 2	
	AM Peak Hour	PM Peak Hour	AM Peak Hour	PM Peak Hour	AM Peak Hour	PM Peak Hour
Haleakala Highway/Old Haleakala Highway (Western Intersection)						
NB LT	--	F	--	--	--	--
NB RT	--	B	--	--	--	--
Haleakala Highway/Old Haleakala Highway (Western Intersection, signalized)						
NB LT	--	--	E*	B	F*	B
WB TH	--	--	F*	B	E	B
EB TH	--	--	C	B	C	B
Overall	--	--	E	B	E	B
Haleakala Highway/Makani Road						
NB LT/TH	E	F*	--	--	--	--
NB RT	A	B	--	--	--	--
SB LT/TH	F*	F*	--	--	--	--
SB RT	F*	B	--	--	--	--
WB LT	A	A	--	--	--	--
EB LT	A	A	--	--	--	--
Haleakala Highway/Makani Road (signalized)						
NB LT/TH	--	--	B	C	B	C
NB RT	--	--	B	C	B	C
SB LT/TH	--	--	B	C	B	C
SB RT	--	--	C	C	C	C
WB LT	--	--	B	A	B	A
WB TH/RT	--	--	C	A	C	A
EB LT	--	--	B	A	B	A
EB TH/RT	--	--	B	A	B	A
Overall	--	--	C	A	C	A

*V/c (volume to capacity ratio) > 1.0

**Table 14 (continued)
LOS at Study Intersections
Year 2006 With Phase 1 and Phase 2**

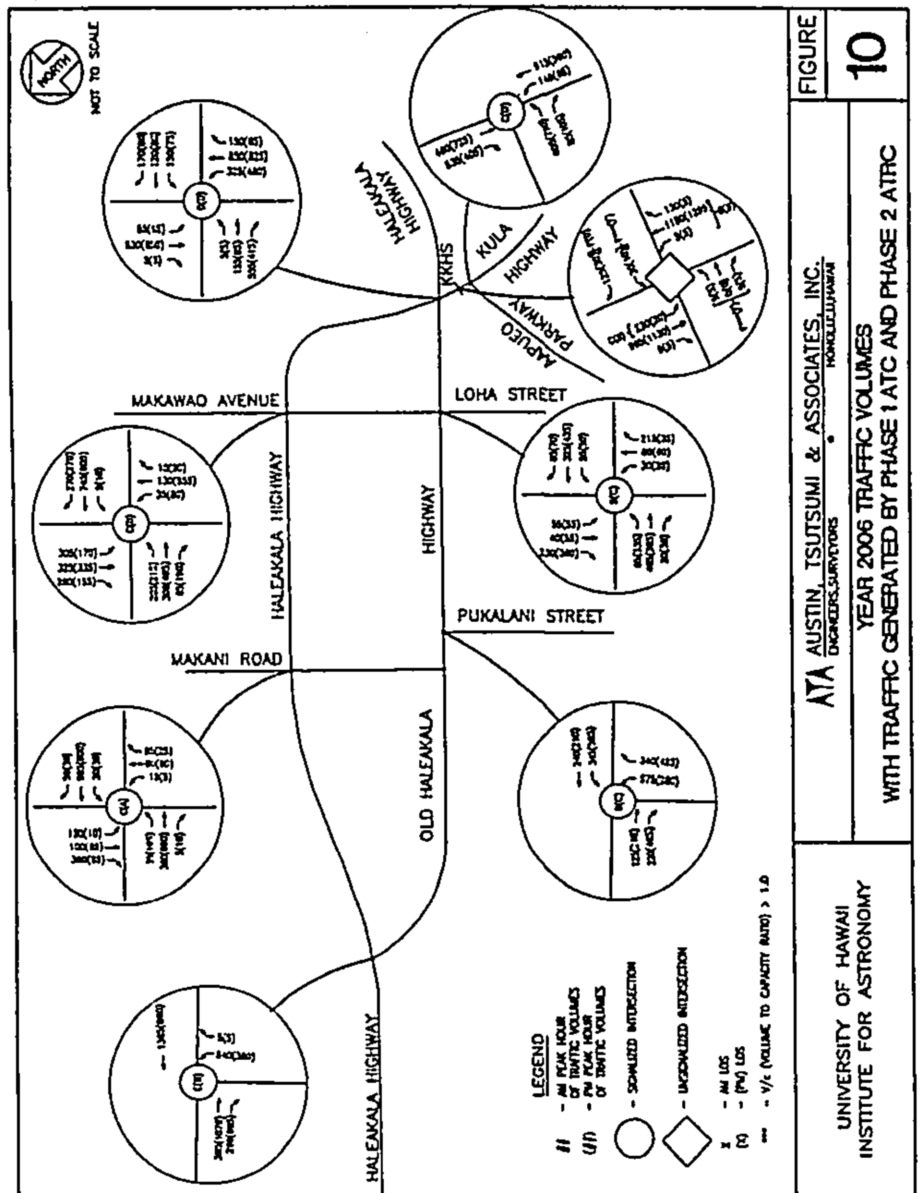
	Existing		Base Year 2006 with Mitigative Measures		Year 2006 with Phase 1 & Phase 2	
	AM Peak Hour	PM Peak Hour	AM Peak Hour	PM Peak Hour	AM Peak Hour	PM Peak Hour
Haleakala Highway/Makawao Avenue						
NB LT	B	B	D	E	D	E
NB TH	B	C	D	E	D	E
NB RT	B	A	C	B	C	C
SB LT	D	D	D	E	D	E
SB TH	B	B	C	C	C	C
SB RT	B	A	B	B	B	B
WB LT	C	C	D	E	D	E
WB TH	C	C	D	E	D	E
WB RT	B	C	B	D	B	D
EB LT	D	C	D	E	D	E
EB TH	B	B	C	D	C	D
EB RT	B	B	B	C	B	C
Overall	C	C	C	D	C	D
Haleakala Highway/Kula Highway/Old Haleakala Highway (Five Trees Junction)						
NB LT	C	C	E	E	E	E
NB TH	C	B	D	C	D	C
SB LT	C	C	D	E	E	E
SB TH	B	B	D	D	D	E
SB RT	B	B	C	C	C	C
WB LT/TH	C	C	E	E	E	E
EB LT/TH	C	C	C	D	C	D
Overall	C	B	D	D	D	D
Old Haleakala Highway/Pukalani Street						
NB LT	C	B	C	C	C	C
NB RT	A	B	A	C	A	C
WB LT	C	B	C	D	C	D
WB TH	B	A	B	A	B	A
EB TH	C	B	C	B	B	B
EB RT	A	A	A	A	A	A
Overall	C	B	B	C	B	C

*V/c (volume to capacity ratio) > 1.0

**Table 14 (continued)
LOS at Study Intersections
Year 2006 With Phase 1 and Phase 2**

	Existing		Base Year 2006 with Mitigative Measures		Year 2006 with Phase 1 & Phase 2	
	AM Peak Hour	PM Peak Hour	AM Peak Hour	PM Peak Hour	AM Peak Hour	PM Peak Hour
Old Haleakala Highway/Makawao Avenue/Loha Street						
NB LT/TH/RT	B	B	C	B	C	B
SB LT/TH	B	B	B	B	B	B
SB RT	C	C	C	D	C	D
WB LT/TH/RT	B	B	C	C	C	C
EB LT	A	A	A	A	A	A
EB TH/RT	A	A	A	A	A	A
Overall	B	B	B	C	B	C
Kula Highway/KKHS Driveway/Residential Driveway						
NB LT/TH	A	A	B	B	B	B
SB LT	B	A	C	B	C	B
WB LT	F	E	F*	F	F*	F
WB RT	C	C	E	D	F	D
EB LT/TH/RT	F	E	F*	F	F*	F
Kula Highway/Aapueo Parkway						
NB LT	A	A	--	--	--	--
EB LT	F*	F*	--	--	--	--
EB RT	B	B	--	--	--	--
Kula Highway/Aapueo Parkway (signalized)						
NB LT	--	--	B	E	B	E
NB TH	--	--	C	C	C	C
SB TH	--	--	B	D	B	D
SB RT	--	--	A	A	A	A
EB LT	--	--	D	D	D	D
EB RT	--	--	C	B	C	B
Overall	--	--	C	C	C	D

*V/c (volume to capacity ratio) > 1.0



UNIVERSITY OF HAWAII INSTITUTE FOR ASTRONOMY

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YEAR 2006 TRAFFIC VOLUMES WITH TRAFFIC GENERATED BY PHASE 1 ATC AND PHASE 2 ATRC

FIGURE 10

VI. CONCLUSIONS

A. Existing

1. The northbound left-turn at the Haleakala Highway/Old Haleakala Highway (Western Intersection) currently operates at LOS F during the PM peak hour of traffic. Review of 24-hour traffic volumes collected in 2001 by SDOT at this intersection indicates the installation of a traffic signal system is warranted.

2. Some movements at the Haleakala Highway/Makani Road Intersection currently operate at LOS E or LOS F during the AM and PM peak hours of traffic. Review of 24-hour traffic volumes collected in 2001 by SDOT at this location indicate the installation of a traffic signal system is warranted. A traffic signal system at this intersection is planned for construction by SDOT and for the purposes of this study assumed to be operational by Year 2005.

3. The westbound left-turn and traffic on the eastbound shared driveway approach at the Kula Highway/KKHS Driveway/Residential Driveway Intersection currently operate at LOS E or LOS F during the AM and PM peak hours of traffic. Existing traffic volumes at this intersection do not warrant installation of a traffic signal system. It is not uncommon, however, for a low volume side street to experience long delays especially when trying to cross or execute a left-turn onto a major regional facility such as Kula Highway. In addition, few vehicles use the shared driveway approach, five (5) vehicles and three (3) vehicles during the AM and PM peak hours, respectively.

4. The eastbound left-turn at the Kula Highway/Aapueo Parkway Intersection operates at LOS F during the AM and PM peak hours of traffic. Existing traffic volumes at this intersection warrant the installation of a traffic signal system. A traffic signal at this intersection is currently in the design process and for the purposes of this study assumed to be operational by Year 2005.

B. **Base Year 2005**

The following are the conclusions of the traffic study for conditions for Base Year 2005 without traffic generated by the proposed Project.

1. Construction of the known developments near the Project could potentially generate approximately 574 and 477 total trips during the AM and PM peak hours of traffic, respectively.
2. At the Haleakala Highway/Old Haleakala Highway (Western Intersection), the northbound left-turn will operate at LOS F during the AM and PM peak hours of traffic. With the installation of a traffic signal system, the northbound left-turn and westbound through traffic will operate at LOS F during the PM peak hour of traffic. This is assuming phasing such that the signal will stop all the westbound through traffic on Haleakala Highway and assign the right-of-way to the northbound traffic on Old Haleakala Highway (i.e. creating a separate phase for each approach). The widening of Haleakala Highway from Hana Highway to the Old Haleakala Highway/Haleakala Highway (Western Intersection) will provide an additional westbound through lane. Haleakala Highway east of Old Haleakala Highway/Haleakala Highway (Western Intersection) as a single lane feed would allow the traffic signal system to only stop eastbound traffic on Haleakala Highway and northbound traffic on Old Haleakala Highway. The northbound left-turn from Old Haleakala Highway would have a dedicated lane west of the intersection. Using this traffic signal phasing will result in the Haleakala Highway/Old Haleakala Highway (Western Intersection) operating overall at LOS A with all individual movements operating at LOS D or better during the AM and PM peak hours of traffic.
3. With the installation of a traffic signal system at the Haleakala Highway/Makani Road Intersection, all individual movements will operate at LOS D or better.

4. Haleakala Highway will be near capacity within the study area with some movements at the Haleakala Highway/Makawao Avenue Intersection operating at LOS E.
5. At the Kula Highway/KKHS Driveway/Residential Driveway, the westbound left-turn from the KKHS driveway approach and eastbound traffic on the shared residential driveway approach will operate at LOS F during the AM and PM peak hours of traffic. In addition, the westbound right-turn will operate at LOS E during the AM peak hour of traffic. Traffic volumes at this intersection are not likely to warrant installation of a traffic signal system. It is not uncommon, however, for a low volume side street to experience long delays especially when trying to cross or execute a left-turn onto a major regional facility such as Kula Highway. In addition, few vehicles are projected to use the shared driveway approach, ten (10) vehicles during the AM peak hour of traffic and ten (10) vehicles during the PM peak hour of traffic.
6. With the installation of a traffic signal system at the Kula Highway/Aapueo Parkway Intersection, all individual movements will operate at LOS D or better.

C. **Base Year 2006**

The following are the conclusions of the traffic study for conditions for Base Year 2006 without traffic generated by the proposed Project.

1. Construction of the known developments near the Project could potentially generate approximately 1,205 and 2,056 total trips during the AM and PM peak hours of traffic, respectively.
2. Haleakala Highway will be operating at overcapacity conditions between the Haleakala Highway/Old Haleakala Highway (Western Intersection) and Five Trees Junction with some movements at the Haleakala Highway/Old Haleakala Highway (Western Intersection), Haleakala Highway/Makani Road and Haleakala Highway/Makawao Avenue intersections operating at LOS E or LOS F.

3. With widening of Haleakala Highway from three (3) to four (4) lanes (two (2) lanes in each direction) from the Haleakala Highway/Old Haleakala Highway (Western Intersection) to west of the Five Trees Junction, the Haleakala Highway/Old Haleakala Highway intersection northbound left-turn will operate at LOS E and westbound through traffic will operate at LOS F. This is assuming phasing such that the signal will stop all the westbound through traffic on Haleakala Highway and assign the right-of-way to the northbound left-turn traffic on Old Haleakala Highway (i.e. creating a separate phase for each approach). It may be possible to allow these movements to proceed through the intersection simultaneously if an acceleration lane is provided to receive the northbound left-turning vehicles. In this case, vehicles turning left from northbound Old Haleakala Highway onto westbound Haleakala Highway would merge with traffic further west of the intersection. The westbound through vehicles would not be controlled by the traffic signal system and would be allowed to proceed continuously. Using this alternate traffic signal will result in the intersection operating overall at LOS A with all individual movements operating at LOS D or better during the AM and PM peak hours of traffic.

4. Widening of Haleakala Highway to four lanes as described will result in all individual movements at the Haleakala Highway/ Makani Road operating at LOS D or better.

5. With the widening of Haleakala Highway and provision of a protected left-turn phase for traffic on the minor street approaches, some movements at the Haleakala Highway/Makawao Avenue intersection will operate at LOS E during the PM peak hour of traffic.

6. The Five Trees Junction will be near capacity with some movements operating at LOS E.

7. At the Kula Highway/KKHS Driveway/Residential Driveway, the westbound left-turn from the KKHS driveway approach and eastbound traffic on the shared residential driveway approach will operate at LOS F during the AM and PM peak hours of traffic. In addition, the westbound right-turn will operate at LOS E during the AM peak hour of traffic. Traffic volumes at this intersection are not likely to warrant installation of a traffic signal system. It is not uncommon, however, for a low volume side street to experience long delays especially when trying to cross or execute a left-turn onto a major regional facility such as Kula Highway. In addition, few vehicles are projected to use the shared driveway approach, ten (10) vehicles during the AM peak hour of traffic and ten (10) vehicles during the PM peak hour of traffic.

8. The Kula Highway/Aapueo Parkway intersection will be approaching capacity with the northbound left-turn operating at LOS E during the PM peak hour of traffic.

D. **Year 2005 with Phase 1**

The following are the conclusions of the traffic study for Year 2005 with Phase 1 of the Project.

1. Development of Phase 1 of the Project could potentially generate approximately 31 and 24 total trips during the AM and PM peak hours of traffic, respectively.

2. The trip generation estimate for Phase 1 is conservative as it assumes worst-case conditions for the peak hours of traffic. IFA staff will likely enter and exit at various times of the day based on viewing conditions at the summit rather than at a fixed time.

3. Approximately two-thirds of the estimated Phase 1 traffic should be considered as "diverted or re-routed existing traffic" since Phase 1 is a relocation of the existing IFA Waiakoa Laboratory in Kula. The analysis is conservative as Project-generated traffic was added to base year volumes without accounting for the diversion.

4. Traffic operations will be similar to Base Year 2005 conditions.

E. **Year 2006 with Phase 1 and Phase 2**

The following are the conclusions of the traffic study for Year 2006 with Phase 1 and Phase 2 of the Project.

1. Development of the Project (Phase 1 and Phase 2) could potentially generate approximately 97 and 91 total trips during the AM and PM peak hours of traffic, respectively.
2. Traffic operations will be similar to Base Year 2006 conditions.
3. The Kula Highway/Aapueo Parkway intersection will be operating near capacity. Any additional traffic at this intersection may require eastbound double left-turn lanes on Aapueo Parkway.

VI. RECOMMENDATIONS

A. Without Project-Generated Traffic

The following are the recommendations of the traffic study without Project-generated traffic.

1. **Base Year 2005**

- Install traffic signal systems at the Haleakala Highway/Old Haleakala Highway (Western Intersection) and Haleakala Highway/Makani Road Intersections. Interconnect and synchronize these traffic signal systems with existing traffic signals along Haleakala Highway at Makawao Avenue and the Five Trees Junction. Synchronization of these traffic signal systems may provide additional gaps in traffic on Kula Highway for turning movements on the minor approaches at the unsignalized Kula Highway/KKHS Driveway/Residential Driveway Intersection.
- Install a traffic signal system at the Kula Highway/Aapueo Parkway Intersection.

2. **Base Year 2006**

- Widen Haleakala Highway to four (4) lanes, (two (2) lanes in each direction) from the Haleakala Highway/Old Haleakala Highway (Western Intersection) to west of the Five Trees junction.
- At the Haleakala Highway/Old Haleakala Highway (Western Intersection), provide a westbound acceleration lane on Haleakala Highway to receive northbound left-turns from Old Haleakala Highway. Provide a traffic signal system phasing such that the westbound through traffic on Haleakala Highway and northbound left-turn traffic proceed through the intersection simultaneously. In this case, vehicles turning left from northbound Old Haleakala Highway onto westbound Haleakala Highway would accelerate and merge with traffic on Haleakala Highway further west of the intersection. The westbound through vehicles would not be controlled by the traffic signal system and would be allowed to proceed continuously.
- Revise the traffic signal system at the Haleakala Highway/Makawao Avenue Intersection to provide a protected left-turn phase for traffic on the minor street approaches.
- Adjust the traffic signal timing at the Five Trees Junction to be coordinated with the revised traffic signal system at the Haleakala Highway/Makani Road Intersection.

B. With Project-Generated Traffic

The following are the recommendations of the traffic study with Project-generated traffic.

1. **Year 2005 with Phase 1**

There are no specific recommendations of the traffic study with traffic generated by Phase 1 of the Project.

2. **Year 2006 with Phase 1 and Phase 2**

There are no specific recommendations of the traffic study with traffic generated by Phase 2 of the Project.

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APPENDICES

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APPENDIX A
TRAFFIC COUNT DATA

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Honolulu, Hawaii 96817
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Major Street: Haleakala Hwy
Minor Street: Old Haleakala Hwy
Time of Count: 6:30 AM-8:30 AM
Weather: Clear

File Name : haloldarr
Site Code : 0000000
Start Date : 05/01/20
Page No : 1

Groups Printed- Unshifted

	Southbound					HALEAKALA HWY Westbound					OLD HALEAKALA HWY Northbound					HALEAKALA HWY Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Factor	1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		
06:30 AM	0	0	0	0	0	0	323	0	0	323	196	0	0	0	196	0	0	88	0	88	607
06:45 AM	0	0	0	0	0	0	301	0	0	301	205	0	0	0	205	0	0	101	0	101	607
Total	0	0	0	0	0	0	624	0	0	624	401	0	0	0	401	0	0	189	0	189	1214
07:00 AM	0	0	0	0	0	0	300	0	0	300	250	0	0	0	250	0	0	134	0	134	684
07:15 AM	0	0	0	0	0	0	323	0	0	323	195	0	0	0	195	0	0	147	0	147	665
07:30 AM	0	0	0	0	0	0	292	0	0	292	158	0	0	0	158	0	0	112	1	113	563
07:45 AM	0	0	0	0	0	0	261	0	0	261	155	0	0	0	155	0	0	106	0	106	522
Total	0	0	0	0	0	0	1173	0	0	1173	758	0	0	0	758	0	0	499	1	500	2431
08:00 AM	0	0	0	0	0	0	196	0	0	196	144	0	0	0	144	0	0	118	0	118	458
08:15 AM	0	0	0	0	0	0	167	0	0	167	105	0	0	0	105	0	0	99	0	99	371
Grand Total	0	0	0	0	0	0	2142	0	0	2142	1408	0	0	0	1408	0	0	905	1	906	4456
Apprch %	0.0	0.0	0.0	0.0		0.0	100.0	0.0	0.0		100.0	0.0	0.0	0.0		0.0	0.0	99.9	0.1		
Total %	0.0	0.0	0.0	0.0	0.0	0.0	48.0	0.0	0.0	48.0	31.6	0.0	0.0	0.0	31.6	0.0	0.0	20.3	0.0	20.3	

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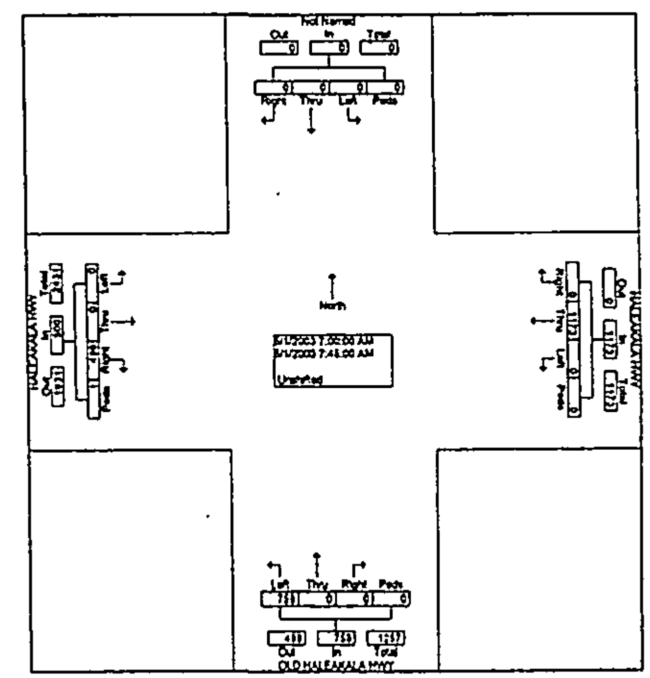
Ph: (808)533-3646 Fax: (808)526-1267

Major Street: Haleakala Hwy
Minor Street: Old Haleakala Hwy
Time of Count: 6:30 AM-8:30 AM
Weather: Clear

File Name : haloldarr
Site Code : 0000000
Start Date : 05/01/20
Page No : 2

	Southbound					HALEAKALA HWY Westbound					OLD HALEAKALA HWY Northbound					HALEAKALA HWY Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour From 07:00 AM to 07:45 AM - Peak 1 of 1																					
Intersection	07:00 AM																				
Volume	0	0	0	0	0	0	1173	0	0	1173	758	0	0	0	758	0	0	499	1	500	2431
Percent	0.0	0.0	0.0	0.0		0.0	100.0	0.0	0.0		100.0	0.0	0.0	0.0		0.0	0.0	99.8	0.2		
07:00 Volume	0	0	0	0	0	0	300	0	0	300	250	0	0	0	250	0	0	134	0	134	684
Peak Factor																					0.889
High Int.						07:15 AM					07:00 AM					07:15 AM					
Volume	0	0	0	0	0	0	323	0	0	323	250	0	0	0	250	0	0	147	0	147	
Peak Factor										0.908					0.758					0.850	



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Ph: (808)533-3646 Fax: (808)526-1267

Major Street: Haleakala Hwy
Minor Street: Makani Rd
Time of Count: 6:30 AM-8:30 AM
Weather: Clear

File Name : halmaka
Site Code : 0000000
Start Date : 05/01/20
Page No : 1

Groups Printed- Unshifted

	MAKANI RD Southbound					HALEAKALA HWY Westbound					MAKANI RD Northbound					HALEAKALA HWY Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Factor	1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		
06:30 AM	5	6	79	0	90	1	224	1	0	226	10	20	8	0	38	0	0	0	0	0	354
06:45 AM	2	10	60	0	72	9	214	0	0	223	5	28	18	0	51	0	0	0	0	0	346
Total	7	16	139	0	162	10	438	1	0	449	15	48	26	0	89	0	0	0	0	0	700
07:00 AM	13	21	102	1	134	1	211	4	0	216	2	22	31	0	55	0	0	0	0	0	403
07:15 AM	18	20	89	0	127	2	226	15	0	243	3	36	45	0	84	0	0	0	0	0	454
07:30 AM	36	38	101	0	175	5	177	15	0	197	3	34	37	0	74	1	2	0	0	3	449
07:45 AM	17	17	52	0	81	10	202	6	0	218	7	25	18	0	51	1	0	0	0	1	361
Total	76	97	344	1	518	15	816	43	0	874	15	115	132	0	262	2	2	0	0	4	1658
08:00 AM	3	16	42	0	60	2	141	1	0	144	3	13	13	0	29	0	0	0	0	0	233
08:15 AM	6	11	29	0	46	4	125	3	0	132	6	12	11	0	29	0	0	1	0	1	208
Grand Total	92	139	554	1	786	34	1520	45	0	1599	39	188	182	0	409	2	2	1	0	5	2799
Apprch %	11.7	17.7	70.5	0.1		2.1	95.1	2.8	0.0		9.5	46.0	44.5	0.0		40.0	40.0	20.0	0.0		
Total %	3.3	5.0	19.8	0.0	28.1	1.2	54.3	1.6	0.0	57.1	1.4	6.7	6.5	0.0	14.6	0.1	0.1	0.0	0.0	0.2	

Austin Tsutsumi & Associates, Inc.
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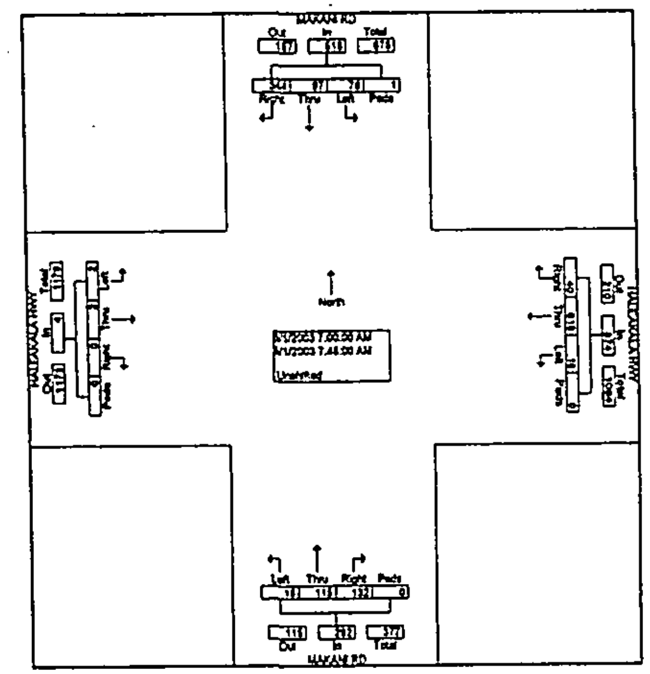
Major Street: Haleakala Hwy
Minor Street: Makani Rd
Time of Count: 6:30 AM-8:30 AM
Weather: Clear

File Name : halmaka
Site Code : 0000000
Start Date : 05/01/20
Page No : 2

	MAKANI RD Southbound					HALEAKALA HWY Westbound					MAKANI RD Northbound					HALEAKALA HWY Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour From 06:30 AM to 08:15 AM - Peak 1 of 1																					
Intersection 07:00 AM																					
Volume	76	97	344	1	518	15	816	43	0	874	15	115	132	0	262	2	2	0	0	4	1658
Percent	14.7	18.7	66.4	0.2		2.1	93.4	4.6	0.0		5.7	43.9	50.4	0.0		50.0	50.0	0.0	0.0		
07:15 Volume	18	20	89	0	127	2	226	15	0	243	3	36	45	0	84	0	0	0	0	0	454
Peak Factor																					0.913
High Int.	07:30 AM					07:15 AM					07:15 AM					07:30 AM					
Volume	36	38	101	0	175	2	226	15	0	243	3	36	45	0	84	1	2	0	0	3	
Peak Factor					0.736					0.899					0.780					0.333	



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Major Street: Haleakala Hwy
Minor Street: Makawao Ave
Time of Count: 6:30 AM-8:30 AM
Weather: Clear

File Name : halmwca
Site Code : 0000000
Start Date : 05/01/20
Page No : 1

Groups Printed- Unshifted

	MAKAWAO AVE Southbound					HALEAKALA HWY Westbound					MAKAWAO AVE Northbound					HALEAKALA HWY Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Factor	1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		
06:30 AM	38	34	88	0	160	0	129	20	0	149	11	34	0	0	45	5	11	1	0	17	371
06:45 AM	49	44	106	0	199	1	111	20	0	132	4	36	1	0	41	9	7	1	0	17	389
Total	87	78	194	0	359	1	240	40	0	281	15	70	1	0	86	14	18	2	0	34	760
07:00 AM	62	87	67	1	217	0	124	46	0	170	8	38	2	0	48	15	15	3	1	34	447
07:15 AM	46	48	64	0	158	3	172	50	0	225	8	63	1	0	72	31	30	3	0	64	519
07:30 AM	73	59	57	0	189	2	144	65	0	211	7	47	4	0	58	23	44	8	0	75	533
07:45 AM	49	74	59	0	182	1	140	64	1	206	7	56	1	0	64	15	15	4	0	34	486
Total	230	248	267	1	744	6	580	225	1	812	28	204	8	0	240	85	106	15	1	207	2003
08:00 AM	56	74	58	0	188	4	72	34	0	110	11	58	3	0	72	8	5	0	1	14	384
08:15 AM	38	87	47	1	173	1	67	27	1	96	18	59	2	0	79	8	8	3	0	19	364
Grand Total	411	487	566	2	1464	12	959	325	2	1299	72	391	14	0	477	115	134	20	2	271	3513
Apprch %	28.0	33.2	38.6	0.1		0.9	73.8	25.1	0.2		15.1	82.0	2.9	0.0		42.4	49.4	7.4	0.7		
Total %	11.7	13.9	16.1	0.1	41.7	0.3	27.3	9.3	0.1	37.0	2.0	11.1	0.4	0.0	13.6	3.3	3.8	0.6	0.1	7.7	

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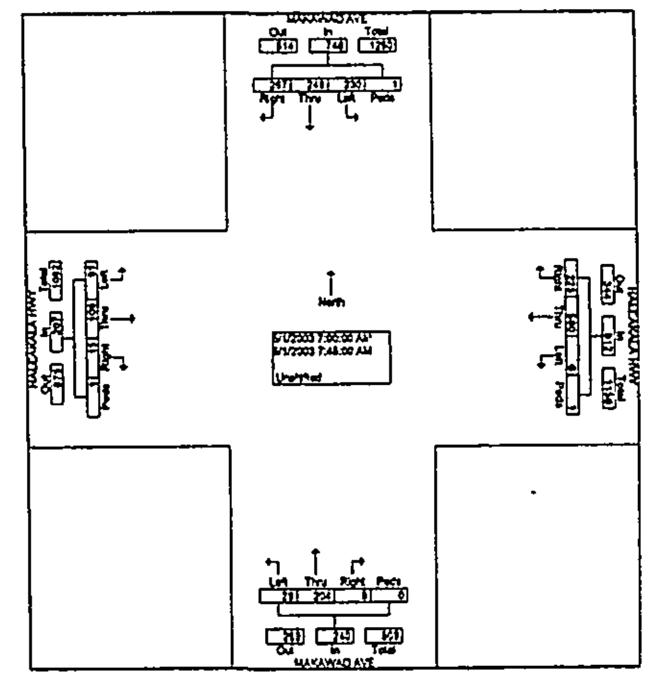
Major Street: Haleakala Hwy
Minor Street: Makawao Ave
Time of Count: 6:30 AM-8:30 AM
Weather: Clear

File Name : halmwca
Site Code : 0000000
Start Date : 05/01/20
Page No : 2

	MAKAWAO AVE Southbound					HALEAKALA HWY Westbound					MAKAWAO AVE Northbound					HALEAKALA HWY Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour From 06:30 AM to 08:15 AM - Peak 1 of 1																					
Intersection	07:00 AM																				
Volume	230	248	267	1	744	6	580	225	1	812	28	204	8	0	240	85	106	15	1	207	2003
Percent	30.8	33.2	35.9	0.1		0.7	71.4	27.7	0.1		11.7	85.0	3.3	0.0		41.1	51.2	7.2	0.5		
07:30 Volume	73	59	57	0	189	2	144	65	0	211	7	47	4	0	58	23	44	8	0	75	533
Peak Factor																					0.940
High Int.	07:00 AM					07:15 AM					07:15 AM					07:30 AM					
Volume	62	87	67	1	217	3	172	50	0	225	8	63	1	0	72	23	44	8	0	75	
Peak Factor					0.857					0.902					0.833					0.690	



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Major Street: Kula Hwy
Minor Street: Haleakala Hwy/Old Haleakal
Time of Count: 6:30 AM-8:30 AM
Weather: Clear

File Name : halkulam
Site Code : 0000000
Start Date : 05/01/20
Page No : 1

Groups Printed- Unshifted

	KULA HWY Southbound					HALEAKALA HWY Westbound					KULA HWY Northbound					OLD HALEAKALA HWY Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Factor	1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		
06:30 AM	4	45	0	0	49	1	7	26	1	34	23	120	3	0	143	1	8	76	0	85	311
06:45 AM	8	49	0	0	57	9	12	30	0	51	29	102	4	0	134	0	14	90	0	104	348
Total	12	94	0	0	106	10	19	56	1	85	49	222	7	0	277	1	22	166	0	189	657
07:00 AM	18	58	0	0	76	9	26	44	0	79	39	136	11	0	186	0	40	86	0	126	467
07:15 AM	8	81	0	0	89	31	20	45	0	96	36	173	24	0	233	0	48	119	0	167	585
07:30 AM	25	99	1	0	125	31	29	40	0	100	69	164	48	0	281	0	43	138	0	181	687
07:45 AM	10	64	0	0	74	30	20	32	0	82	72	169	37	0	278	1	28	78	0	107	541
Total	61	302	1	0	364	101	95	161	0	357	216	644	104	0	964	1	160	420	0	581	2266
08:00 AM	3	64	0	0	67	4	12	17	0	33	41	91	4	0	136	2	9	74	0	85	321
08:15 AM	2	43	1	0	46	14	5	14	0	33	49	84	6	0	139	0	16	57	0	73	291
Grand Total	78	503	2	0	583	131	131	247	1	509	354	1041	124	0	1519	4	208	716	0	928	3539
Apprch %	13.4	86.3	0.3	0.0		25.7	25.7	48.4	0.2		23.3	68.5	8.2	0.0		0.4	22.4	77.2	0.0		
Total %	2.2	14.2	0.1	0.0	16.5	3.7	3.7	7.0	0.0	14.4	10.0	29.4	3.5	0.0	42.9	0.1	5.9	20.2	0.0	26.2	

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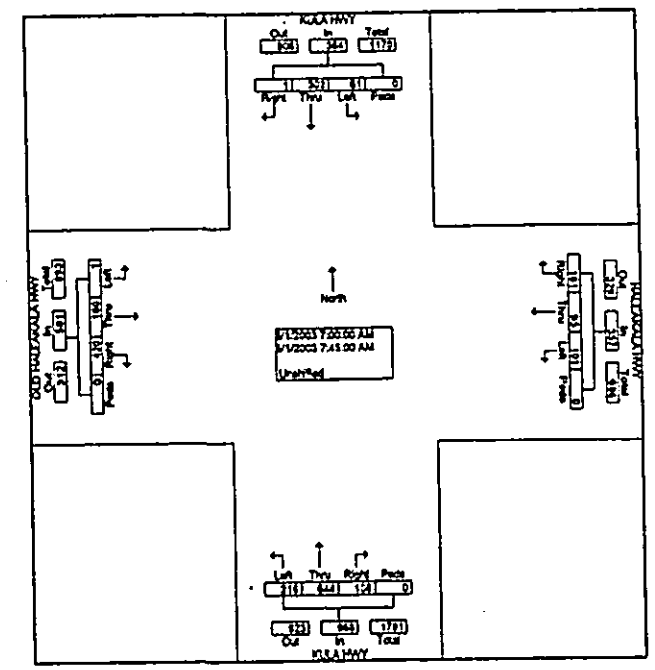
Major Street: Kula Hwy
Minor Street: Haleakala Hwy/Old Haleakal
Time of Count: 6:30 AM-8:30 AM
Weather: Clear

File Name : halkulam
Site Code : 0000000
Start Date : 05/01/20
Page No : 2

	KULA HWY Southbound					HALEAKALA HWY Westbound					KULA HWY Northbound					OLD HALEAKALA HWY Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour From 06:30 AM to 08:15 AM - Peak 1 of 1																					
Intersection	07:00 AM																				
Volume	61	302	1	0	364	101	95	161	0	357	216	644	104	0	964	1	160	420	0	581	2266
Percent	16.8	83.0	0.3	0.0		28.3	26.6	45.1	0.0		22.4	66.8	10.8	0.0		0.2	27.5	72.3	0.0		
07:30 Volume	25	99	1	0	125	31	29	40	0	100	69	164	48	0	281	0	43	138	0	181	687
Peak Factor																					0.825
High Int.	07:30 AM					07:30 AM					07:30 AM					07:30 AM					
Volume	25	99	1	0	125	31	29	40	0	100	69	164	48	0	281	0	43	138	0	181	
Peak Factor					0.728					0.893					0.858					0.802	



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Major Street: Old Haleakala Hwy
Minor Street: Pukalani St
Time of Count: 6:30 AM-8:30 AM
Weather: Clear

File Name : oldpukam
Site Code : 00000000
Start Date : 05/01/2003
Page No : 1

Groups Printed- Unshifted

	Southbound					OLD HALEAKALA HWY Westbound					PUKALANI ST Northbound					OLD HALEAKALA HWY Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Factor	1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		
06:30 AM	0	0	0	0	0	22	47	0	1	70	117	0	29	0	146	0	71	15	0	88	304
06:45 AM	0	0	0	0	0	40	37	0	0	77	151	0	28	0	179	0	67	21	0	98	353
Total	0	0	0	0	0	62	84	0	1	147	268	0	57	0	325	0	138	47	0	185	657
07:00 AM	0	0	0	0	0	45	56	0	0	101	169	0	38	0	206	0	63	48	0	112	418
07:15 AM	0	0	0	0	0	63	51	0	0	114	134	0	51	0	185	0	74	56	1	131	430
07:30 AM	0	0	0	0	0	74	36	0	1	111	134	0	62	0	196	0	86	57	1	144	451
07:45 AM	0	0	0	0	0	91	40	0	0	131	114	0	48	5	168	0	60	49	0	109	405
Total	0	0	0	0	0	273	183	0	1	457	551	0	195	5	751	0	283	211	2	496	1704
08:00 AM	0	0	0	0	0	55	51	0	2	108	73	0	33	0	106	0	83	31	0	114	328
08:15 AM	0	0	0	0	0	65	31	0	0	96	88	0	34	0	122	0	49	54	0	103	321
Grand Total	0	0	0	0	0	455	349	0	4	808	980	0	319	5	1304	0	553	343	2	898	3010
Apprch %	0.0	0.0	0.0	0.0		56.3	43.2	0.0	0.5		75.2	0.0	24.5	0.4		0.0	61.6	38.2	0.2		
Total %	0.0	0.0	0.0	0.0	0.0	15.1	11.6	0.0	0.1	26.8	32.6	0.0	10.6	0.2	43.3	0.0	18.4	11.4	0.1	29.8	

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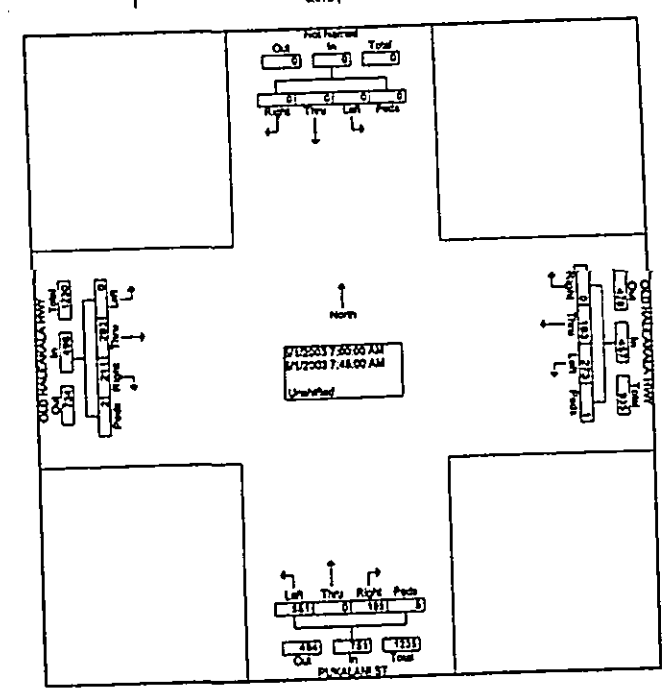
Major Street: Old Haleakala Hwy
Minor Street: Pukalani St
Time of Count: 6:30 AM-8:30 AM
Weather: Clear

File Name : oldpukam
Site Code : 00000000
Start Date : 05/01/2003
Page No : 2

	Southbound					OLD HALEAKALA HWY Westbound					PUKALANI ST Northbound					OLD HALEAKALA HWY Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour From 06:30 AM to 08:15 AM - Peak 1 of 1																					
Intersection	07:00 AM																				
Volume	0	0	0	0	0	273	183	0	1	457	551	0	195	5	751	0	283	211	2	496	1704
Percent	0.0	0.0	0.0	0.0		59.7	40.0	0.0	0.2		73.4	0.0	26.0	0.7		0.0	57.1	42.5	0.4		
07:30 Volume	0	0	0	0	0	74	36	0	1	111	134	0	62	0	196	0	86	57	1	144	451
Peak Factor																					0.945
High Int.	8:15:00 AM					07:45 AM					07:00 AM					07:30 AM					
Volume	0	0	0	0	0	91	40	0	0	131	169	0	38	0	207	0	86	57	1	144	
Peak Factor										0.872					0.919					0.861	



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Major Street: Old Haleakala Hwy
Minor Street: Makawao Ave/Loha St
Time of Count: 6:30 AM-8:30 AM
Weather: Clear

File Name : oldmwos
Site Code : 0000000
Start Date : 05/01/20
Page No : 1

Groups Printed- Unshifted

	MAKAWAO AVE Southbound					OLD HALEAKALA HWY Westbound					LOHA ST Northbound					OLD HALEAKALA HWY Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Factor	1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		
06:30 AM	12	2	25	0	39	5	17	6	0	28	10	15	4	0	29	28	70	4	0	102	198
06:45 AM	11	6	33	0	50	7	30	5	0	42	7	8	9	0	24	30	80	2	1	113	229
Total	23	8	58	0	89	12	47	11	0	70	17	23	13	0	53	58	150	6	1	215	427
07:00 AM	15	4	64	0	83	12	42	18	0	72	9	14	32	1	56	25	92	3	0	120	331
07:15 AM	10	7	41	0	58	7	46	10	0	63	6	27	53	0	86	47	102	3	0	152	359
07:30 AM	16	13	46	0	75	15	59	6	0	80	5	21	42	0	68	38	124	5	0	167	390
07:45 AM	8	12	57	0	77	15	71	25	0	111	8	12	23	1	44	53	79	8	2	142	374
Total	49	36	208	0	293	49	218	59	0	326	28	74	150	2	254	163	397	19	2	581	1454
08:00 AM	11	8	56	0	75	4	43	11	0	58	7	17	12	0	36	47	62	6	3	118	287
08:15 AM	8	7	67	0	82	6	38	14	0	58	3	12	10	0	25	66	47	6	0	119	284
Grand Total	91	59	389	0	539	71	346	95	0	512	55	126	185	2	368	334	656	37	6	1033	2452
Apprch %	16.9	10.9	72.2	0.0		13.9	67.6	18.6	0.0		14.9	34.2	50.3	0.5		32.3	63.5	3.6	0.6		
Total %	3.7	2.4	15.9	0.0	22.0	2.9	14.1	3.9	0.0	20.9	2.2	5.1	7.5	0.1	15.0	13.6	26.8	1.5	0.2	42.1	

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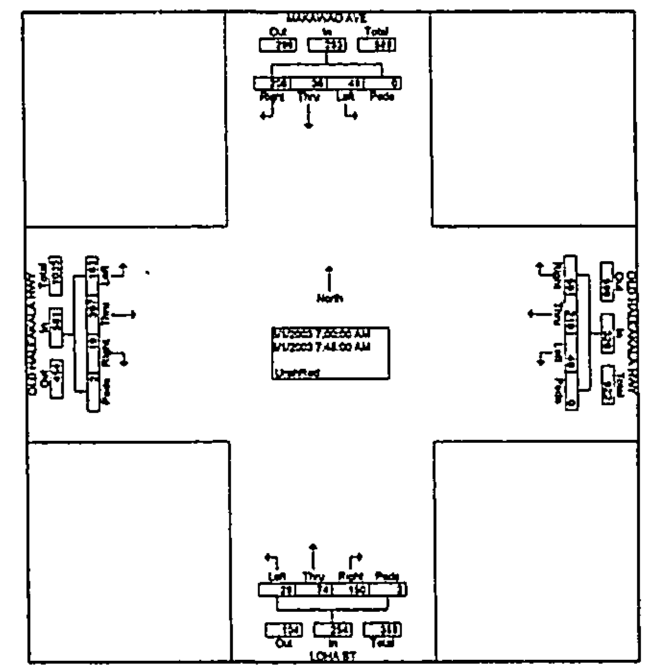
Major Street: Old Haleakala Hwy
Minor Street: Makawao Ave/Loha St
Time of Count: 6:30 AM-8:30 AM
Weather: Clear

File Name : oldmwos
Site Code : 0000000
Start Date : 05/01/20
Page No : 2

	MAKAWAO AVE Southbound					OLD HALEAKALA HWY Westbound					LOHA ST Northbound					OLD HALEAKALA HWY Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour From 06:30 AM to 08:15 AM - Peak 1 of 1																					
Intersection	07:00 AM																				
Volume	49	36	208	0	293	49	218	59	0	326	28	74	150	2	254	163	397	19	2	581	1454
Percent	16.7	12.3	71.0	0.0		15.0	66.9	18.1	0.0		11.0	29.1	59.1	0.8		28.1	68.3	3.3	0.3		
07:30 Volume	16	13	46	0	75	15	59	6	0	80	5	21	42	0	68	38	124	5	0	167	390
Peak Factor																					0.932
High Int.	07:00 AM					07:45 AM					07:15 AM					07:30 AM					
Volume	15	4	64	0	83	15	71	25	0	111	6	27	53	0	86	38	124	5	0	167	
Peak Factor					0.883					0.734					0.738					0.870	



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Major Street: Haleakala Hwy
Minor Street: Old Haleakala Hwy
Time of Count: 2:45 PM-4:45 PM
Weather: Clear

File Name : haloldprr
Site Code : 0000000
Start Date : 04/30/20
Page No : 1

Groups Printed- Unshifted

	Southbound					HALEAKALA HWY Westbound					OLD HALEAKALA HWY Northbound					HALEAKALA HWY Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Factor	1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		
02:45 PM	0	0	0	0	0	0	109	0	0	109	74	0	0	0	74	0	139	89	0	228	411
Total	0	0	0	0	0	0	109	0	0	109	74	0	0	0	74	0	139	89	0	228	411
03:00 PM	0	0	0	0	0	0	139	0	0	139	58	0	0	0	58	0	111	102	0	213	410
03:15 PM	0	0	0	0	0	0	140	0	0	140	58	0	0	0	58	0	143	118	0	261	459
03:30 PM	0	0	0	0	0	0	172	0	0	172	85	0	1	0	86	0	161	143	0	304	562
03:45 PM	0	0	0	0	0	0	166	0	0	166	65	0	1	0	66	0	167	132	0	299	531
Total	0	0	0	0	0	0	617	0	0	617	266	0	2	0	268	0	582	495	0	1077	1962
04:00 PM	0	0	0	0	0	0	133	0	0	133	78	0	1	0	79	0	178	145	0	323	535
04:15 PM	0	0	0	0	0	0	142	0	0	142	66	0	0	0	66	0	176	145	0	321	529
04:30 PM	0	0	0	0	0	0	137	0	0	137	76	0	0	0	76	0	174	180	5	359	572
Grand Total	0	0	0	0	0	0	1138	0	0	1138	557	0	3	0	560	0	1239	1064	5	2308	4006
Apprch %	0.0	0.0	0.0	0.0		0.0	100.0	0.0	0.0		99.5	0.0	0.5	0.0		0.0	53.7	46.1	0.2		
Total %	0.0	0.0	0.0	0.0	0.0	0.0	28.4	0.0	0.0	28.4	13.9	0.0	0.1	0.0	14.0	0.0	30.9	26.6	0.1	57.6	

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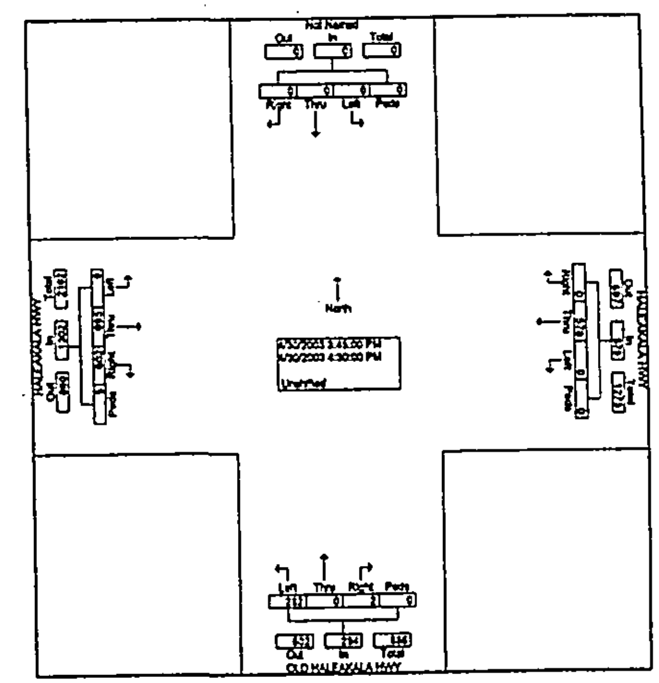
Major Street: Haleakala Hwy
Minor Street: Old Haleakala Hwy
Time of Count: 2:45 PM-4:45 PM
Weather: Clear

File Name : haloldprr
Site Code : 0000000
Start Date : 04/30/20
Page No : 2

	Southbound					HALEAKALA HWY Westbound					OLD HALEAKALA HWY Northbound					HALEAKALA HWY Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour From 03:45 PM to 04:30 PM - Peak 1 of 1																					
Intersection 03:45 PM																					
Volume	0	0	0	0	0	0	578	0	0	578	282	0	2	0	284	0	695	622	5	1322	2184
Percent	0.0	0.0	0.0	0.0		0.0	100.0	0.0	0.0		99.3	0.0	0.7	0.0		0.0	53.4	46.2	0.4		
04:30 Volume	0	0	0	0	0	0	137	0	0	137	76	0	0	0	76	0	174	180	5	359	572
Peak Factor																					0.948
High Int.						03:45 PM					04:00 PM					04:30 PM					
Volume	0	0	0	0	0	0	166	0	0	166	75	0	1	0	76	0	174	180	5	359	
Peak Factor										0.870					0.934					0.927	



Major Street: Haleakala Hwy
Minor Street: Makani Rd
Time of Count: 2:45 PM-4:45 PM
Weather: Clear

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File Name : halmakp
Site Code : 0000000
Start Date : 04/30/20
Page No : 1

Groups Printed- Unshifted

	MAKANI RD Southbound					HALEAKALA HWY Westbound					MAKANI RD Northbound					HALEAKALA HWY Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Factor	1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		
02:45 PM	4	25	25	0	54	7	98	5	0	110	0	12	3	0	15	22	108	2	0	132	311
Total	4	25	25	0	54	7	98	5	0	110	0	12	3	0	15	22	108	2	0	132	311
03:00 PM	0	16	26	0	42	5	113	4	0	122	1	13	2	0	16	24	91	2	0	117	297
03:15 PM	4	24	21	0	49	6	108	2	0	116	1	23	2	0	26	24	98	1	0	123	314
03:30 PM	2	18	24	0	44	7	154	3	1	165	1	19	3	0	23	37	129	1	1	168	397
03:45 PM	2	11	20	0	33	8	143	5	0	156	1	22	5	0	28	33	133	1	0	167	384
Total	8	69	91	0	168	26	518	14	1	559	4	74	12	0	90	118	451	5	1	575	1392
04:00 PM	1	18	15	0	34	12	117	7	0	136	1	16	5	0	22	50	133	3	0	186	378
04:15 PM	3	12	22	0	37	3	110	6	0	119	2	19	8	0	29	30	123	2	0	155	343
04:30 PM	2	8	28	0	38	6	104	4	1	115	3	23	4	1	31	40	141	1	0	182	371
Grand Total	18	132	179	0	329	53	948	36	2	1039	10	144	32	1	187	264	963	13	1	1240	2795
Apprch %	5.5	40.1	54.4	0.0		5.1	91.2	3.5	0.2		5.3	77.0	17.1	0.5		21.3	77.4	1.0	0.1		
Total %	0.6	4.7	6.4	0.0	11.8	1.9	33.9	1.3	0.1	37.2	0.4	5.2	1.1	0.0	6.7	9.4	34.3	0.5	0.0	44.4	

Major Street: Haleakala Hwy
Minor Street: Makani Rd
Time of Count: 2:45 PM-4:45 PM
Weather: Clear

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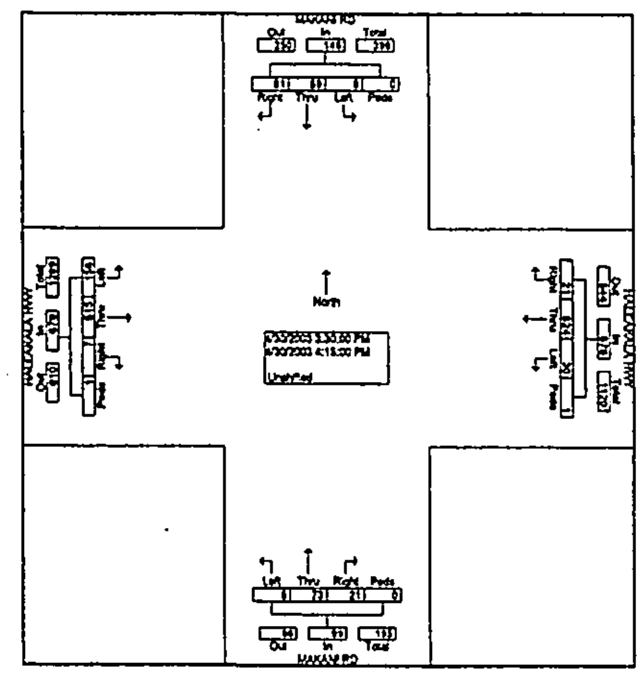
File Name : halmakp
Site Code : 0000000
Start Date : 04/30/20
Page No : 2

	MAKANI RD Southbound					HALEAKALA HWY Westbound					MAKANI RD Northbound					HALEAKALA HWY Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour From 02:45 PM to 04:30 PM - Peak 1 of 1																					
Intersection	03:30 PM																				
Volume	8	59	81	0	148	30	524	21	1	576	5	73	21	0	99	156	515	7	1	679	1502
Percent	5.4	39.9	54.7	0.0		5.2	91.0	3.6	0.2		5.1	73.7	21.2	0.0		23.0	75.8	1.0	0.1		
03:30 Volume	2	18	24	0	44	7	154	3	1	165	1	19	3	0	23	37	129	1	1	168	397
Peak Factor																					0.946
High Int.	03:30 PM					03:30 PM					04:15 PM					04:00 PM					
Volume	2	18	24	0	44	7	154	3	1	165	2	19	8	0	29	50	133	3	0	186	
Peak Factor					0.841					0.873					0.853					0.913	



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Major Street: Haleakala Hwy
Minor Street: Makawao Ave
Time of Count: 2:45 PM-4:45 PM
Weather: Clear

File Name : halmwoc
Site Code : 0000000
Start Date : 04/30/20
Page No : 1

Groups Printed- Unshifted

	MAKAWAO AVE Southbound					HALEAKALA HWY Westbound					MAKAWAO AVE Northbound					HALEAKALA HWY Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Factor	1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		
02:45 PM	26	70	26	0	122	5	80	38	1	124	6	84	3	0	93	54	48	16	0	118	457
Total	26	70	26	0	122	5	80	38	1	124	6	84	3	0	93	54	48	16	0	118	457
03:00 PM	32	72	31	0	135	2	80	33	0	115	6	61	4	0	71	39	44	9	0	92	413
03:15 PM	32	66	32	0	130	1	80	58	0	139	12	63	3	0	78	41	61	10	0	112	459
03:30 PM	22	88	48	0	158	1	92	51	0	144	15	90	3	0	108	60	64	10	0	134	544
03:45 PM	28	64	40	0	132	3	99	48	0	150	10	101	5	1	117	63	70	13	0	133	532
Total	114	290	151	0	555	7	351	190	0	548	43	315	15	1	374	193	239	39	0	471	1948
04:00 PM	34	61	38	0	133	1	82	61	0	144	9	91	2	0	102	49	78	9	0	136	515
04:15 PM	29	74	29	0	132	3	74	36	0	113	7	90	6	0	103	58	64	12	0	134	472
04:30 PM	26	62	23	0	108	3	78	39	1	122	8	80	1	0	90	72	63	9	1	145	463
Grand Total	229	547	272	0	1048	19	678	354	2	1051	73	661	27	1	762	426	483	83	1	992	3853
Apprch %	21.9	52.2	26.0	0.0		1.8	64.5	33.7	0.2		9.6	86.7	3.5	0.1		42.9	48.6	8.4	0.1		
Total %	5.9	14.2	7.1	0.0	27.2	0.5	17.6	9.2	0.1	27.3	1.9	17.2	0.7	0.0	19.8	11.1	12.5	2.2	0.0	25.7	

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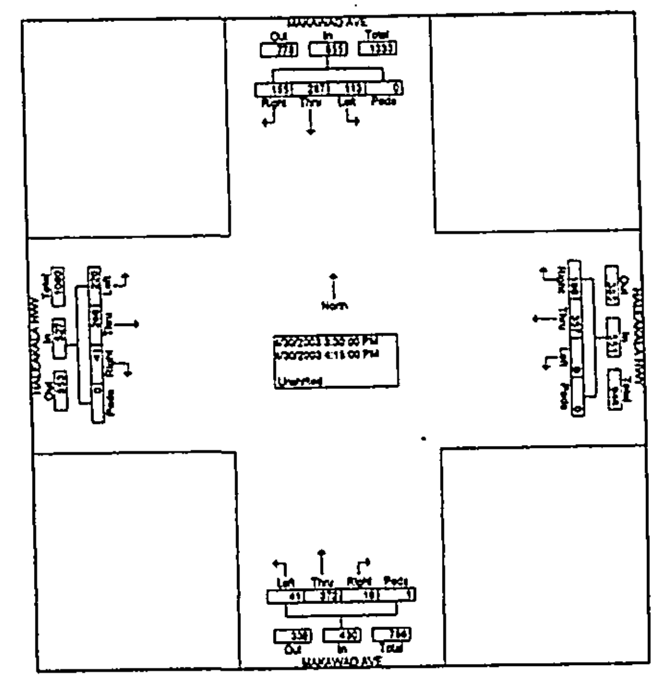
Major Street: Haleakala Hwy
Minor Street: Makawao Ave
Time of Count: 2:45 PM-4:45 PM
Weather: Clear

File Name : halmwoc
Site Code : 0000000
Start Date : 04/30/20
Page No : 2

	MAKAWAO AVE Southbound					HALEAKALA HWY Westbound					MAKAWAO AVE Northbound					HALEAKALA HWY Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour From 02:45 PM to 04:30 PM - Peak 1 of 1																					
Intersection	03:30 PM																				
Volume	113	297	155	0	565	8	357	186	0	551	41	372	16	1	430	220	266	41	0	527	2073
Percent	20.4	51.7	27.9	0.0		1.5	64.8	33.8	0.0		9.5	86.5	3.7	0.2		41.7	50.5	7.8	0.0		
03:30 Volume	22	88	48	0	158	1	92	51	0	144	15	90	3	0	108	60	64	10	0	134	544
Peak Factor																					0.953
High Int.	03:30 PM					03:45 PM					03:45 PM					04:00 PM					
Volume	22	88	48	0	158	3	99	48	0	150	10	101	5	1	117	49	78	9	0	136	
Peak Factor					0.894					0.918					0.919					0.969	



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Major Street: Kula Hwy
Minor Street: Haleakala Hwy/Old Haleakal
Time of Count: 2:45 PM-4:45 PM
Weather: Clear

File Name : halkulpm
Site Code : 0000000
Start Date : 04/30/20
Page No. : 1

Groups Printed- Unshifted

	KULA HWY Southbound					HALEAKALA HWY Westbound					KULA HWY Northbound					OLD HALEAKALA HWY Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Factor	1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		
02:45 PM	12	78	1	0	91	11	13	16	0	40	58	108	17	0	183	0	10	65	0	75	389
Total	12	78	1	0	91	11	13	16	0	40	58	108	17	0	183	0	10	65	0	75	389
03:00 PM	13	63	1	0	77	10	27	23	0	60	37	85	13	0	135	1	13	56	0	70	342
03:15 PM	10	80	0	0	90	9	12	30	0	51	58	106	7	0	174	0	19	61	0	80	385
03:30 PM	10	88	1	0	99	17	13	13	0	43	67	147	11	0	225	1	16	44	0	61	428
03:45 PM	12	85	0	0	97	7	11	25	0	43	61	120	7	0	188	0	16	61	0	77	425
Total	45	316	2	0	363	43	63	81	0	187	224	440	38	0	722	2	64	222	0	288	1570
04:00 PM	12	105	0	0	117	11	17	20	0	48	55	116	8	0	179	0	13	49	0	62	406
04:15 PM	15	80	0	0	95	7	11	19	0	37	58	100	9	0	167	0	16	53	0	69	368
04:30 PM	20	61	1	0	82	5	15	27	0	47	42	93	9	0	144	1	11	46	0	58	331
Grand Total	104	640	4	0	748	77	118	173	0	368	437	877	81	0	1365	3	114	435	0	552	3064
Apprch %	13.9	85.6	0.5	0.0		20.9	32.2	46.9	0.0		31.3	62.9	5.8	0.0		0.5	20.7	78.8	0.0		
Total %	3.4	20.9	0.1	0.0	24.4	2.5	3.9	5.6	0.0	12.0	14.3	28.6	2.6	0.0	45.5	0.1	3.7	14.2	0.0	18.0	

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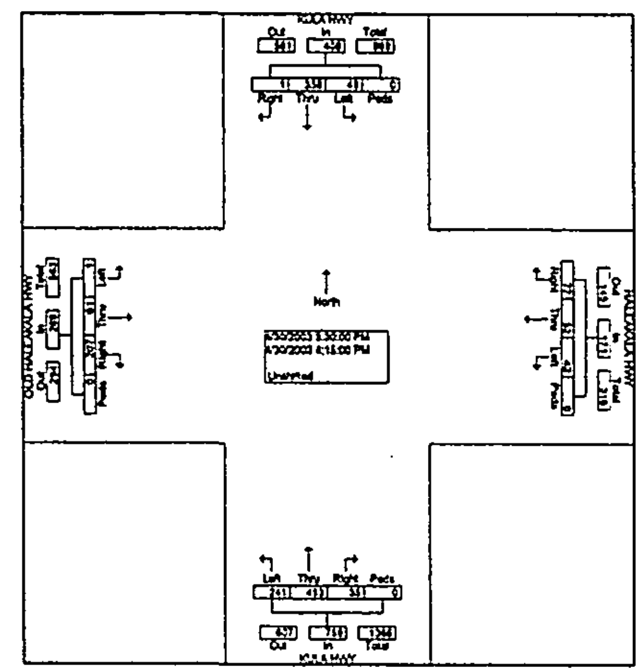
Major Street: Kula Hwy
Minor Street: Haleakala Hwy/Old Haleakal
Time of Count: 2:45 PM-4:45 PM
Weather: Clear

File Name : halkulpm
Site Code : 0000000
Start Date : 04/30/20
Page No : 2

	KULA HWY Southbound					HALEAKALA HWY Westbound					KULA HWY Northbound					OLD HALEAKALA HWY Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour From 03:30 PM to 04:15 PM - Peak 1 of 1																					
Intersection	03:30 PM																				
Volume	49	355	1	0	405	42	52	77	0	171	241	483	35	0	759	1	61	207	0	269	1627
Percent	12.0	87.7	0.2	0.0		24.6	30.4	45.0	0.0		31.8	63.6	4.6	0.0		0.4	22.7	77.0	0.0		
03:30 Volume	10	88	1	0	99	17	13	13	0	43	67	147	11	0	225	1	16	44	0	61	428
Peak Factor																					0.939
High Int.	04:00 PM					04:00 PM					03:30 PM					03:45 PM					
Volume	12	105	0	0	117	11	17	20	0	48	67	147	11	0	225	0	16	61	0	77	
Peak Factor					0.872					0.891					0.843					0.873	



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Major Street: Old Haleakala Hwy
Minor Street: Pukalani St
Time of Count: 2:45 PM-4:45 PM
Weather: Clear

File Name : oldpukpm
Site Code : 00000000
Start Date : 04/30/2003
Page No : 1

Groups Printed- Unshifted

	Southbound					OLD HALEAKALA HWY Westbound					PUKALANI ST Northbound					OLD HALEAKALA HWY Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Factor	1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		
02:45 PM	0	0	0	0	0	83	29	0	0	109	56	0	72	0	128	0	30	81	0	111	348
Total	0	0	0	0	0	83	29	0	0	109	56	0	72	0	128	0	30	81	0	111	348
03:00 PM	0	0	0	0	0	77	18	0	0	95	55	0	66	0	121	0	31	82	0	113	329
03:15 PM	0	0	0	0	0	88	24	0	0	112	66	0	78	0	144	0	38	73	0	111	367
03:30 PM	0	0	0	0	0	95	27	0	0	122	66	0	65	0	131	0	46	108	1	154	427
03:45 PM	0	0	0	0	0	95	20	0	0	115	73	0	85	0	158	0	39	116	0	155	479
Total	0	0	0	0	0	335	89	0	0	444	262	0	292	0	554	0	153	379	1	533	1531
04:00 PM	0	0	0	0	0	67	44	0	0	111	76	0	84	0	160	0	33	114	0	147	417
04:15 PM	0	0	0	0	0	63	25	0	0	84	64	0	63	3	123	0	43	107	0	150	360
04:30 PM	0	0	0	0	0	70	28	0	0	88	75	0	76	1	153	0	32	120	0	152	403
Grand Total	0	0	0	0	0	841	216	0	0	334	623	0	582	4	1119	0	291	801	1	1063	3088
Apprch %	0.0	0.0	0.0	0.0		74.6	25.1	0.0	0.0		48.7	0.0	52.8	0.4		0.0	26.6	73.3	0.1		
Total %	0.0	0.0	0.0	0.0	0.0	23.9	7.0	0.0	0.0	27.0	17.0	0.0	19.3	0.1	36.5	0.0	9.5	26.1	0.0	35.8	

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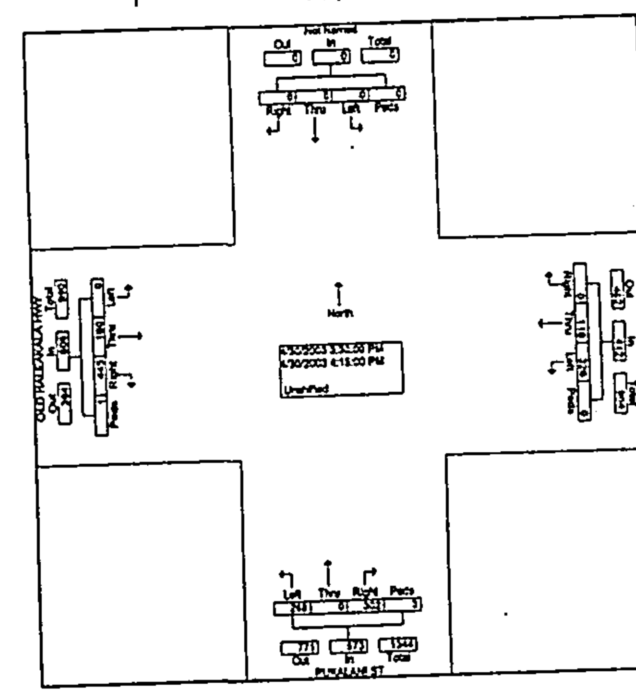
Major Street: Old Haleakala Hwy
Minor Street: Pukalani St
Time of Count: 2:45 PM-4:45 PM
Weather: Clear

File Name : oldpukpm
Site Code : 00000000
Start Date : 04/30/2003
Page No : 2

	Southbound					OLD HALEAKALA HWY Westbound					PUKALANI ST Northbound					OLD HALEAKALA HWY Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour From 02:45 PM to 04:30 PM - Peak 1 of 1																					
Intersection 03:30 PM																					
Volume	0	0	0	0	0	326	116	0	0	442	258	0	302	3	573	0	160	445	1	606	1621
Percent	0.0	0.0	0.0	0.0		73.8	26.2	0.0	0.0		46.8	0.0	52.7	0.5		0.0	26.4	73.4	0.2		
03:45 Volume	0	0	0	0	0	95	23	0	0	118	73	0	85	0	158	0	39	116	0	155	428
Peak Factor																					0.947
High Int.	2:30:00 PM					03:30 PM					04:00 PM					03:45 PM					
Volume	0	0	0	0	0	95	27	0	0	122	75	0	84	0	159	0	39	116	0	155	
Peak Factor										0.906					0.901					0.977	



Major Street: Old Haleakala Hwy
Minor Street: Makawao Ave/Loha St
Time of Count: 2:45 PM-4:45 PM
Weather: Clear

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File Name : oldmwoc
Site Code : 0000000
Start Date : 04/30/20
Page No : 1

Groups Printed- Unshifted

	MAKAWAO AVE Southbound					OLD HALEAKALA HWY Westbound					LOHA ST Northbound					OLD HALEAKALA HWY Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Factor	1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		
02:45 PM	6	12	58	0	76	14	58	12	0	84	2	12	9	0	23	73	56	3	2	134	318
Total	6	12	58	0	76	14	58	12	0	84	2	12	9	0	23	73	56	3	2	134	318
03:00 PM	13	9	63	0	85	4	52	9	0	65	4	9	9	0	22	67	47	6	2	122	294
03:15 PM	26	13	55	0	94	11	42	12	0	65	2	13	13	0	28	78	48	1	0	125	312
03:30 PM	11	14	75	0	100	10	59	21	0	90	2	18	7	0	27	74	42	2	0	118	335
03:45 PM	17	12	65	0	94	7	51	13	0	71	4	17	8	1	30	79	54	6	0	139	332
Total	67	48	258	0	373	32	204	55	0	291	12	57	35	1	105	298	191	15	2	494	1263
04:00 PM	8	9	61	0	78	8	48	13	0	69	8	16	3	0	27	74	51	5	0	130	299
04:15 PM	9	19	63	0	91	13	45	13	1	72	6	8	8	0	22	73	55	15	0	143	328
04:30 PM	13	14	49	0	76	8	53	5	0	66	3	11	5	0	19	63	45	4	1	110	271
Grand Total	123	102	489	0	694	72	428	98	1	579	28	104	63	1	196	566	388	42	5	1011	2480
Apprch %	14.8	14.7	70.5	0.0		12.4	73.9	16.9	0.2		14.3	53.1	32.1	0.5		56.0	38.4	4.2	0.5		
Total %	4.2	4.1	19.7	0.0	28.0	2.9	18.5	4.0	0.0	23.3	1.1	4.2	2.5	0.0	7.9	22.8	16.0	1.7	0.2	40.8	

Major Street: Old Haleakala Hwy
Minor Street: Makawao Ave/Loha St
Time of Count: 2:45 PM-4:45 PM
Weather: Clear

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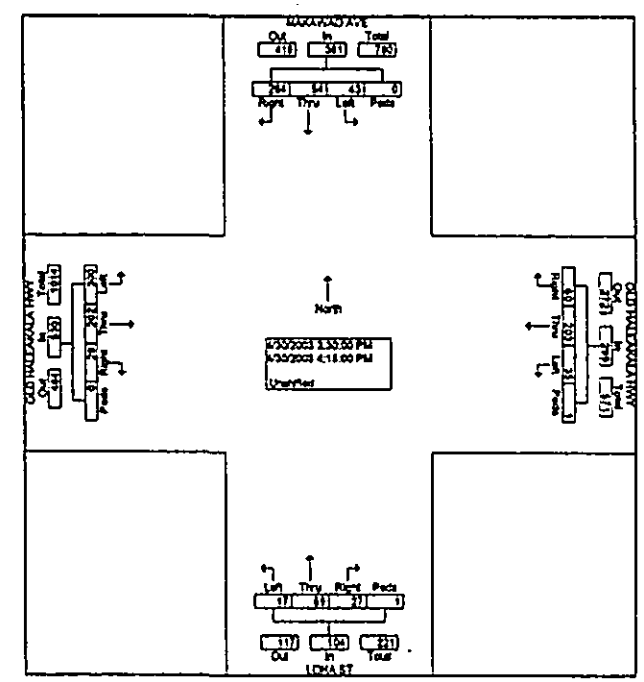
File Name : oldmwoc
Site Code : 0000000
Start Date : 04/30/20
Page No : 2

	MAKAWAO AVE Southbound					OLD HALEAKALA HWY Westbound					LOHA ST Northbound					OLD HALEAKALA HWY Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour From 02:45 PM to 04:30 PM - Peak 1 of 1																					
Intersection	03:30 PM																				
Volume	43	54	294	0	341	35	203	63	1	299	17	59	27	1	104	300	232	28	0	530	1294
Percent	11.9	15.8	72.1	0.0		11.7	67.9	23.1	0.3		16.3	56.7	26.0	1.0		56.6	34.1	6.3	0.0		
03:30 Volume	11	14	75	0	100	10	59	21	0	90	2	18	7	0	27	74	42	2	0	118	335
Peak Factor																					0.966
High Int.	03:30 PM					03:30 PM					03:45 PM					04:15 PM					
Volume	11	14	75	0	100	10	59	21	0	90	4	17	6	1	28	73	55	15	0	143	
Peak Factor					0.903					0.831					0.929					0.927	



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Major Street: Kula Hwy
Minor Street: King Kekaulike/Residential
Time of Count: 6:30 AM-8:30 AM
Weather: Clear

File Name : kulknam
Site Code : 0000000
Start Date : 05/01/20
Page No : 1

Groups Printed- Unshifted

	KULA HWY Southbound					KING KEKAULIKE SCHOOL Westbound					KULA HWY Northbound					RESIDENTIAL DRWY Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Factor	1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		
06:30 AM	13	104	0	0	125	1	0	4	0	5	0	133	2	0	135	0	0	0	0	0	265
06:45 AM	18	125	1	0	145	2	0	6	0	8	0	115	0	0	141	1	0	0	0	1	294
Total	33	234	1	0	266	3	0	10	0	13	0	264	0	0	276	1	0	0	0	1	559
07:00 AM	28	115	0	0	143	1	0	18	0	19	0	177	25	0	202	0	0	1	0	1	365
07:15 AM	60	173	0	0	229	0	0	23	0	25	0	229	29	0	248	0	0	0	0	0	505
07:30 AM	104	161	0	1	266	7	0	35	0	42	0	213	48	1	261	2	0	1	0	3	572
07:45 AM	49	115	1	2	167	4	0	49	0	53	0	221	29	0	250	0	1	0	0	1	471
Total	231	578	1	3	813	15	0	128	0	143	0	530	131	1	662	2	1	2	0	5	1618
08:00 AM	16	120	0	0	136	3	0	7	0	10	0	123	3	0	126	0	0	0	0	0	272
08:15 AM	8	98	0	0	106	1	1	7	0	9	1	121	3	0	125	0	0	0	0	0	240
Grand Total	286	1020	2	3	1311	25	1	149	0	175	1	1343	144	1	1489	3	1	2	0	6	2981
Apprch %	21.8	77.8	0.2	0.2		14.3	0.6	85.1	0.0		0.1	90.1	9.7	0.1		50.0	16.7	33.3	0.0		
Total %	9.6	34.2	0.1	0.1	44.0	0.8	0.0	5.0	0.0	5.9	0.0	45.0	4.8	0.0	49.9	0.1	0.0	0.1	0.0	0.2	

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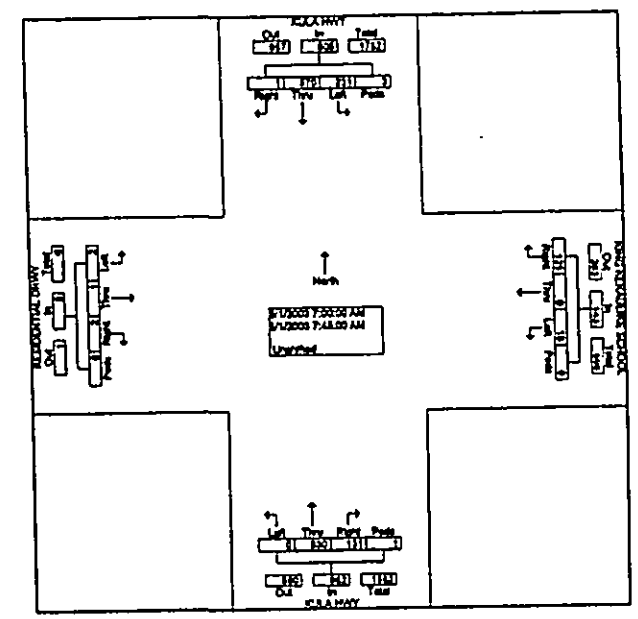
Major Street: Kula Hwy
Minor Street: King Kekaulike/Residential
Time of Count: 6:30 AM-8:30 AM
Weather: Clear

File Name : kulknam
Site Code : 0000000
Start Date : 05/01/20
Page No : 2

	KULA HWY Southbound					KING KEKAULIKE SCHOOL Westbound					KULA HWY Northbound					RESIDENTIAL DRWY Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour From 06:30 AM to 08:15 AM - Peak 1 of 1																					
Intersection	07:00 AM																				
Volume	231	578	1	3	813	15	0	128	0	143	0	530	131	1	662	2	1	2	0	5	1618
Percent	28.7	71.0	0.1	0.4		12.0	0.0	87.4	0.0		0.0	86.3	13.6	0.1		40.0	20.0	40.0	0.0		
07:30 Volume	104	161	0	1	266	7	0	35	0	42	0	212	48	1	261	2	0	1	0	3	572
Peak Factor																					0.837
High Int.	07:30 AM					07:45 AM					07:30 AM					07:30 AM					
Volume	104	161	0	1	266	4	0	49	0	53	0	212	48	1	261	2	0	1	0	3	
Peak Factor					0.767					0.675					0.621					0.417	



Major Street: Kula Hwy
Minor Street: King Kekaulike/Residential
Time of Count: 2:45 PM-4:45 PM
Weather: Clear

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File Name : kulknpm
Site Code : 0000000
Start Date : 04/30/20
Page No : 1

Groups Printed- Unshifted

	KULA HWY Southbound					KING KEKAULIKE SCHOOL Westbound					KULA HWY Northbound					RESIDENTIAL DRWY Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Factor	1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		
02:45 PM	6	145	1	0	152	0	0	4	0	4	1	166	1	0	168	2	0	0	0	2	326
Total	6	145	1	0	152	0	0	4	0	4	1	166	1	0	168	2	0	0	0	2	326
03:00 PM	4	122	0	0	126	6	0	9	0	15	0	122	3	0	125	1	0	0	0	1	267
03:15 PM	5	145	0	0	150	2	0	14	0	16	0	154	3	0	157	0	0	0	0	0	323
03:30 PM	6	133	0	0	139	2	0	13	0	15	0	211	0	0	211	0	0	0	0	0	365
03:45 PM	6	149	1	0	156	1	0	8	0	9	3	174	1	0	178	0	0	1	0	1	344
Total	21	549	1	0	571	11	0	44	0	56	3	661	7	0	671	1	0	1	0	2	1299
04:00 PM	5	168	0	0	173	1	0	6	0	8	0	177	2	0	179	2	0	0	0	2	360
04:15 PM	3	146	5	0	154	3	0	5	0	8	0	167	0	0	167	0	0	0	0	0	317
04:30 PM	2	92	0	0	94	3	0	8	0	11	1	119	0	0	130	1	0	0	0	1	236
Grand Total	37	1096	7	0	1143	18	0	65	0	83	5	1230	10	0	1296	6	0	1	0	7	2528
Apprch %	3.2	96.2	0.6	0.0		21.7	0.0	78.3	0.0		0.4	94.8	0.8	0.0		85.7	0.0	14.3	0.0		
Total %	1.5	43.5	0.3	0.0	45.2	0.7	0.0	2.6	0.0	3.3	0.2	50.9	0.4	0.0	51.2	0.3	0.0	0.0	0.0	0.3	

Major Street: Kula Hwy
Minor Street: King Kekaulike/Residential
Time of Count: 2:45 PM-4:45 PM
Weather: Clear

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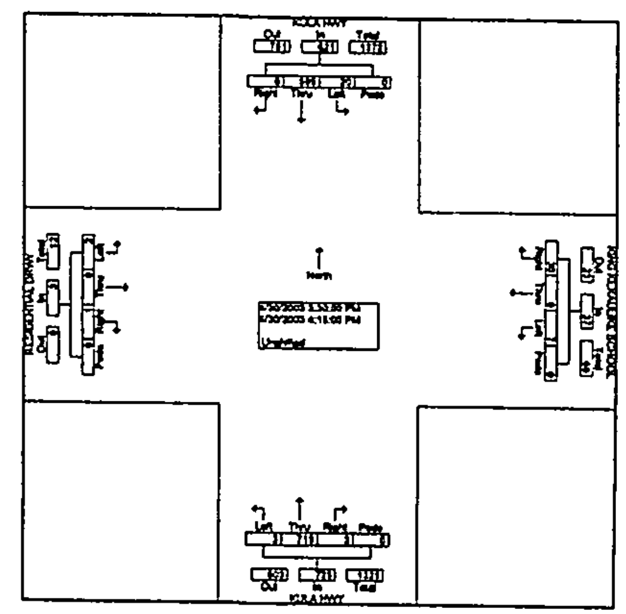
File Name : kulknpm
Site Code : 0000000
Start Date : 04/30/20
Page No : 2

	KULA HWY Southbound					KING KEKAULIKE SCHOOL Westbound					KULA HWY Northbound					RESIDENTIAL DRWY Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour From 03:30 PM to 04:15 PM - Peak 1 of 1																					
Intersection	03:30 PM																				
Volume	20	596	5	0	621	7	0	30	0	37	3	719	3	0	725	2	0	1	0	3	1386
Percent	3.2	96.0	0.8	0.0		18.9	0.0	81.1	0.0		0.4	99.2	0.4	0.0		66.7	0.0	33.3	0.0		
03:30 Volume	6	133	0	0	139	2	0	13	0	15	0	211	0	0	211	0	0	0	0	0	365
Peak Factor																					0.949
High Int.	04:00 PM					03:30 PM					03:30 PM					04:00 PM					
Volume	5	168	0	0	173	2	0	13	0	15	0	211	0	0	211	2	0	0	0	2	
Peak Factor					0.897					0.617					0.859					0.375	



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Major Street: Kula Hwy
Minor Street: Aapueo Pkwy
Time of Count: 6:30 AM-8:30 AM
Weather: Clear

File Name : kulaapam
Site Code : 00000000
Start Date : 05/01/2003
Page No : 1

Groups Printed- Unshifted

	KULA HWY Southbound					Westbound					KULA HWY Northbound					AAPUEO PKWY Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Factor	1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		
06:30 AM	0	72	44	0	116	0	0	0	0	0	2	137	0	0	139	2	0	0	0	2	257
06:45 AM	0	73	55	0	128	0	0	0	0	0	6	134	0	0	140	5	0	0	0	5	273
Total	0	145	99	0	244	0	0	0	0	0	8	271	0	0	279	7	0	0	0	7	530
07:00 AM	0	62	57	0	119	0	0	0	0	0	9	164	0	0	173	36	0	3	0	39	331
07:15 AM	0	93	90	0	183	0	0	0	0	0	22	205	0	0	227	38	0	10	0	48	458
07:30 AM	0	120	57	0	177	0	0	0	0	0	21	234	0	0	255	54	0	17	0	71	503
07:45 AM	0	107	15	0	122	0	0	0	0	0	6	197	0	0	203	36	0	5	0	41	366
Total	0	382	219	0	601	0	0	0	0	0	58	800	0	0	858	164	0	35	0	199	1658
08:00 AM	0	112	9	0	121	0	0	0	0	0	2	108	0	0	110	10	0	2	0	12	243
08:15 AM	0	95	6	0	101	0	0	0	0	0	3	121	0	0	124	4	0	3	0	7	232
Grand Total	0	734	333	0	1067	0	0	0	0	0	71	1300	0	0	1371	185	0	40	0	225	2663
Apprch %	0.0	68.8	31.2	0.0		0.0	0.0	0.0	0.0		5.2	94.8	0.0	0.0		82.2	0.0	17.8	0.0		
Total %	0.0	27.6	12.5	0.0	40.1	0.0	0.0	0.0	0.0	0.0	2.7	48.8	0.0	0.0	51.4	6.9	0.0	1.5	0.0	8.4	

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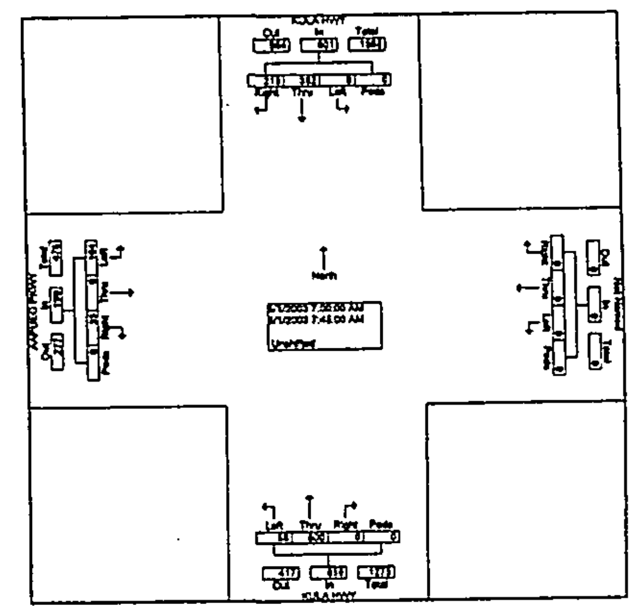
Major Street: Kula Hwy
Minor Street: Aapueo Pkwy
Time of Count: 6:30 AM-8:30 AM
Weather: Clear

File Name : kulaapam
Site Code : 00000000
Start Date : 05/01/2003
Page No : 2

	KULA HWY Southbound					Westbound					KULA HWY Northbound					AAPUEO PKWY Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour From 06:30 AM to 08:15 AM - Peak 1 of 1																					
Intersection	07:00 AM																				
Volume	0	382	219	0	601	0	0	0	0	0	58	800	0	0	858	164	0	35	0	199	1658
Percent	0.0	63.6	36.4	0.0		0.0	0.0	0.0	0.0		6.8	93.2	0.0	0.0		82.4	0.0	17.6	0.0		
07:30 Volume	0	120	57	0	177	0	0	0	0	0	21	234	0	0	255	54	0	17	0	71	503
Peak Factor																					0.824
High Int.	07:15 AM					8:15:00 AM					07:30 AM					07:30 AM					
Volume	0	93	90	0	183	0	0	0	0	0	21	234	0	0	255	54	0	17	0	71	
Peak Factor					0.821										0.841					0.701	



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Major Street: Kula Hwy
Minor Street: Aapueo Pkwy
Time of Count: 2:45 PM-4:45 PM
Weather: Clear

File Name : kulaappr
Site Code : 0000000
Start Date : 04/30/20
Page No : 1

Groups Printed- Unshifted

	KULA HWY Southbound					Westbound					KULA HWY Northbound					AAPUEO PKWY Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Factor	1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		
02:45 PM	0	123	16	0	139	0	0	0	0	0	0	136	0	0	136	32	0	7	0	39	314
Total	0	123	16	0	139	0	0	0	0	0	0	136	0	0	136	32	0	7	0	39	314
03:00 PM	0	110	22	0	132	0	0	0	0	0	2	98	0	0	100	22	0	3	0	25	257
03:15 PM	0	120	24	0	144	0	0	0	0	0	10	101	0	0	111	57	0	4	0	61	316
03:30 PM	0	123	14	0	137	0	0	0	0	0	4	124	0	0	128	88	0	18	0	106	371
03:45 PM	0	134	15	0	149	0	0	0	0	0	4	139	0	0	143	36	0	4	0	40	332
Total	0	486	75	0	562	0	0	0	0	0	20	462	0	0	482	203	0	29	0	232	1277
04:00 PM	0	141	22	0	163	0	0	0	0	0	1	129	0	0	130	51	0	3	0	54	347
04:15 PM	0	139	6	0	145	0	0	0	0	0	0	118	0	0	118	42	0	0	0	42	306
04:30 PM	0	99	2	0	101	0	0	0	0	0	2	130	0	0	132	7	0	3	0	10	343
Grand Total	0	990	121	0	1111	0	0	0	0	0	23	972	0	0	994	336	0	48	0	383	2489
Apprch %	0.0	89.1	10.9	0.0		0.0	0.0	0.0	0.0		2.3	97.7	0.0	0.0		87.6	0.0	12.5	0.0		
Total %	0.0	39.8	4.9	0.0	44.6	0.0	0.0	0.0	0.0	0.0	0.9	39.1	0.0	0.0	40.0	13.5	0.0	1.9	0.0	15.4	

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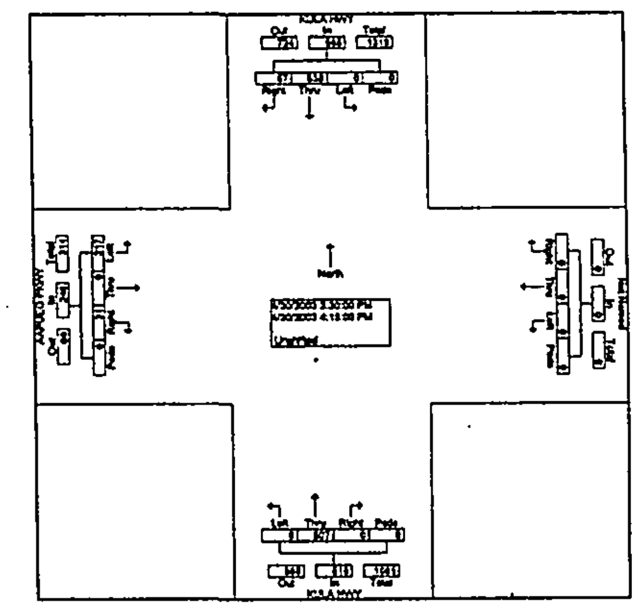
Major Street: Kula Hwy
Minor Street: Aapueo Pkwy
Time of Count: 2:45 PM-4:45 PM
Weather: Clear

File Name : kulaappr
Site Code : 0000000
Start Date : 04/30/20
Page No : 2

	KULA HWY Southbound					Westbound					KULA HWY Northbound					AAPUEO PKWY Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour From 03:30 PM to 04:15 PM - Peak 1 of 1																					
Intersection	03:30 PM																				
Volume	0	533	67	0	600	0	0	0	0	0	9	507	0	0	516	217	0	31	0	248	1364
Percent	0.0	88.8	11.2	0.0		0.0	0.0	0.0	0.0		1.7	98.3	0.0	0.0		87.5	0.0	12.5	0.0		
03:30 Volume	0	123	14	0	137	0	0	0	0	0	4	124	0	0	128	88	0	18	0	106	371
Peak Factor																					0.919
High Int.	04:00 PM										03:45 PM					03:30 PM					
Volume	0	141	22	0	163	0	0	0	0	0	4	139	0	0	143	88	0	18	0	106	
Peak Factor					0.920										0.902					0.585	



APPENDIX B
LEVEL OF SERVICE CRITERIA

LEVEL OF SERVICE CRITERIA FOR UNSIGNALIZED INTERSECTIONS (HCM 2000)

The level of service criteria for unsignalized intersections is defined as the average total delay, in seconds per vehicle. As used here, total delay is defined as the total elapsed time from when a vehicle stops at the end of the queue until the vehicle departs from the stop line; this time includes the time required for the vehicle to travel from the last-in-queue position to the first-in-queue position.

LOS delay threshold values are higher for two-way stop-controlled (TWSC) and all-way stop-controlled (AWSC) intersections than those of signalized intersections. This is because more vehicles pass through signalized intersections, and therefore, drivers expect and tolerate greater delays. While the criteria for level of service for TWSC and AWSC intersections are the same, procedures to calculate the average total delay may differ.

<u>Level of Service Criteria for Two-Way Stop-Controlled Intersections</u>

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

LEVEL OF SERVICE OF SIGNALIZED INTERSECTIONS (HCM 2000)

Level of service for signalized intersections is defined in terms of delay, which is a measure of driver discomfort, frustration, fuel consumption and lost travel time. Specifically, level-of-service criteria are stated in terms of the average stopped delay per vehicle for a 15-minute analysis period. The criteria are given in Table A-1.

<u>Table A-1. Level-of Service Criteria for Signalized Intersections</u>

Level of Service	Stopped Delay per Vehicle (sec.)
A	≤ 10
B	> 10 and ≤ 20
C	> 20 and ≤ 35
D	> 35 and ≤ 55
E	>55 and ≤ 80
F	>80

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

Using the HCM calculation procedure, LOS is determined for each individual approach, as well as for the intersection as a whole.

Level-of-service A describes operations with very low delay, up to 10.0 seconds per vehicle. This level of service occurs when progression is extremely favorable, and most vehicles arrive during the green phase. Most vehicles do not stop at all. Short cycle lengths may also contribute to low delay.

Level-of-service B describes operations with delay greater than 10.0 and up to 20.0 seconds per vehicle. This generally occurs with good progression and/or short cycle lengths. More vehicles stop than for LOS A, causing higher levels of average delay.

Level-of-service C describes operations with delay greater than 20.0 and up to 35.0 seconds per vehicle. These higher delays may result from fair progression and/or longer cycle lengths. Individual cycle failures may begin to appear in this level. The number of vehicles stopping is significant at this level, although many still pass through the intersection without stopping.

Level-of-service D describes operations with delay greater than 35.0 and up to 55.0 seconds per vehicle. At level D, the influence of congestion becomes more noticeable. Longer delays may result from some combination of unfavorable progression, long cycle lengths, or high v/c ratios. Many vehicles stop, and the proportion of vehicles not stopping declines. Individual cycle failures are noticeable.

Level-of-service E describes operations with delay greater than 55.0 and up to 80.0 seconds per vehicle. This level is considered by many agencies to be the limit of acceptable delay. These high delay values generally indicate poor progression, long cycle lengths and high v/c ratios. Individual cycle failures are frequent occurrences.

Level-of-service F describes operations with delay in excess of 80.0 seconds per vehicle. This is considered to be unacceptable to most drivers. This condition often occurs with oversaturation, i.e., when arrival flow rates exceed the capacity of the intersection. It may also occur at high v/c ratios below 1.00 with many individual cycle failures. Poor progression and long cycle lengths may also be major contributing causes to such delay levels.

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APPENDIX C
LEVEL OF SERVICE CALCULATIONS

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APPENDIX C
LEVEL OF SERVICE CALCULATIONS

- Existing

CHAPTER 17 - TWSC - UNSIGNALIZED INTERSECTIONS WORKSHEET

Analysis Summary

General Information		Site Information	
Analyst	TL	Jurisdiction/Date	KULA, MAUI 7/2/2003
Agency or Company	ATA	Major Street	HALEAKALA HWY
Analysis Period/Year	PM PEAK 2003	Minor Street	OLD HALEAKALA HWY
Comment	EXISTING		

Input Data

Lane Configuration	EB	WB	NB	SB
Lane 1 (curb)	T	T	R	
Lane 2	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)		695			0		282		2			
PHF		.9			.9		.9		.9			
Proportion of heavy vehicles, HV		3			3		3		3			
Flow rate		772			0		313		2			
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	R	2	609	.003	<1	10.9	B	70.2
	2	L	313	334	.938	10	70.6	F	F
	3								
SB	1								
	2								
	3								
		①							
		④							

1 of 1

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CHAPTER 17 - TWSC - UNSIGNALIZED INTERSECTIONS WORKSHEET

Analysis Summary

General Information		Site Information	
Analyst	TL	Jurisdiction/Date	KULA, MAUI 6/27/2003
Agency or Company	ATA	Major Street	HALEAKALA HIGHWAY
Analysis Period/Year	AM PEAK 2003	Minor Street	MAKANI ROAD
Comment	EXISTING		

Input Data

Lane Configuration	EB	WB	NB	SB
Lane 1 (curb)	TR	TR	R	R
Lane 2	T	L	LT	LT
Lane 3	L			

	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)	2	2	0	18	816	40	15	115	132	76	97	344
PHF	.9	.9	.9	.9	.9	.9	.9	.9	.9	.9	.9	.9
Proportion of heavy vehicles, HV	2	2	2	2	2	2	2	2	2	2	2	2
Flow rate	2	2	0	20	907	44	17	128	147	84	108	382
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	147	1083	.136	<1	8.8	A	24.8
	2	LT	145	239	.608	4	41	E	C
	3								
SB	1	R	382	269	1.418	21	244.4	F	249.5
	2	LT	192	141	1.359	12	259.9	F	F
	3								
		①	2	718	.003	<1	10	A	
		④	20	1619	.012	<1	7.3	A	

1 of 1

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CHAPTER 17 - TWSC - UNSIGNALIZED INTERSECTIONS WORKSHEET

Analysis Summary

General Information

Analyst	EV	Jurisdiction/Date	KULA, MAUI 6/27/2003
Agency or Company	ATA	Major Street	HALEAKALA HIGHWAY
Analysis Period/Year	PM PEAK 2003	Minor Street	MAKANI ROAD
Comment	EXISTING		

Site Information

Input Data

Lane Configuration	EB	WB	NB	SB
Lane 1 (curb)	TR	TR	R	R
Lane 2	T	L	LT	LT
Lane 3	L			

	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)	156	515	7	30	524	21	5	73	21	8	59	81
PHF	.9	.9	.9	.9	.9	.9	.9	.9	.9	.9	.9	.9
Proportion of heavy vehicles, HV	2	2	2	2	2	2	2	2	2	2	2	2
Flow rate	173	572	8	33	582	23	6	81	23	9	66	90
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	23	707	.033	<1	10.3	B	255.9
	2	LT	87	66	1.31	7	320.9	F	F
	3								
SB	1	R	90	448	.201	1	15	B	220.1
	2	LT	75	48	1.557	7	466.1	F	F
	3								
		①	173	968	.179	1	9.5	A	
		④	33	990	.034	<1	8.8	A	

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1 of 1

Institute for Astronomy
AM Peak Hour of Traffic
Existing

12/23/03
10:35:34

SIGNAL2000/TEAPAC[Ver 1.11.00] - Capacity Analysis Summary

Intersection Averages for Int # 0 - Haleakala Highway/Makawao Aven
Degree of Saturation (v/c) 0.60 Vehicle Delay 24.9 Level of Service C+

```
Sq 16 | Phase 1  | Phase 2  | Phase 3  | Phase 4  |
**/** |          |          |          |          |
      | + + *    | +        | +        |       ^  |
      | + + *    | +        | +        |    ++++  |
 /|\  |<+ + *>   |<+        |<+        |   <****  |
  |   |  v       |     ^ ++++|     ^   |          |
  |   |      ^   |****   v  |++++      |          |
North |   <+ + +>|      +>|++++>       |++++>     |
  |   |    + + + |        + |++++      |++++      |
      |    + + + |        + |   v      |   v      |
      | G/C=0.283 | G/C=0.050 | G/C=0.033 | G/C=0.383 |
      | G= 17.0"  | G=  3.0"  | G=  2.0"  | G= 23.0"  |
      | Y+R= 5.0" | Y+R= 5.0" | Y+R= 0.0" | Y+R= 5.0" |
      | OFF= 0.0% | OFF=36.7% | OFF=50.0% | OFF=53.3% |
      C= 60 sec  G= 45.0 sec = 75.0%  Y=15.0 sec = 25.0%  Ped= 0.0 sec = 0.0%
```

Lane Group	Width/ Lanes	g/C Reqd	g/C Used	Service Rate @C (vph)	Service Rate @E	Adj Volume	v/c	HCM Delay	L S	Queue Model 1
SB Approach								23.3	C+	
RT	12/1	0.243	0.450	659	713	297	0.417	13.0	B+	168 ft
TH	12/1	0.187	0.283	460	528	276	0.523	19.0	B	186 ft
LT	12/1	0.294	0.283	245	302	256	0.848	39.9	*D+	226 ft
NB Approach								17.6	B	
RT	12/1	0.034	0.417	600	660	9	0.014	10.3	B+	5 ft
TH	12/1	0.160	0.283	460	528	227	0.430	18.1	B	148 ft
LT	12/1	0.000	0.283	206	260	31	0.119	16.2	B	19 ft
WB Approach								29.5	C	
RT	12/1	0.216	0.383	529	607	250	0.412	17.3	B	170 ft
TH	12/1	0.381	0.383	648	714	644	0.902	34.3	*C	544 ft
LT	12/1	0.014	0.050	49	76	7	0.080	27.6	C	6 ft
EB Approach								20.9	C+	
RT	12/1	0.046	0.417	600	660	17	0.026	10.4	B+	9 ft
TH	24/2	0.052	0.417	1439	1475	118	0.080	10.6	B+	30 ft
LT	12/1	0.084	0.083	93	137	94	0.639	35.6	*D+	81 ft

Institute for Astronomy
AM Peak Hour of Traffic
Existing

12/23/03
10:36:54

SIGNAL2000/TEAPAC[Ver 1.11.00] - Summary of Parameter Values

Intersection Parameters for Int # 0 - Haleakala Highway/Makawao Aven

METROAREA	NONCBD			
SIMULATION PERIOD	15			
LEVELOFSERVICE	C	S		
NODELOCATION	0	0		
QUEUEMODELS	1	90	25	40

Approach Parameters

	SB	WB	NB	EB
APPLABELS				
GRADES	0.0	0.0	0.0	0.0
PEDLEVELS	0	0	0	0
BIKEVOLUMES	0	0	0	0
PARKINGSIDES	NONE	NONE	NONE	NONE
PARKVOLUMES	20	20	20	20
BUSVOLUMES	0	0	0	0
RIGHTTURNONREDS	0	0	0	0
UPSTREAMVC	0.00	0.00	0.00	0.00

Movement Parameters

MOVLABELS	RT	TH	LT	RT	TH	LT	RT	TH	LT	RT	TH	LT
VOLUMES	267	248	230	225	580	6	8	204	28	15	106	85
WIDTHS	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	24.0	12.0
LANES	1	1	1	1	1	1	1	1	1	1	2	1
GROUPTYPES	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM
UTILIZATIONS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRUCKPERCENTS	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
PEAKHOURFACTORS	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
ARRIVALTYPES	3	3	3	2	2	2	3	3	3	3	3	3
ACTUATIONS	NO	YES	YES	NO	YES	YES	NO	YES	YES	NO	YES	YES
REQCLEARANCES	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
MINIMUMS	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
STARTUPLOST	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
ENDGAIN	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
STORAGE	0	0	0	0	0	0	0	0	0	0	0	0
INITIALQUEUE	0	0	0	0	0	0	0	0	0	0	0	0
IDEALSATFLOWS	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
FACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
DELAYFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
NSTOPFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
SATURATIONFLOWS	1583	1863	1068	1583	1863	1770	1583	1863	919	1583	3539	1770

Phasing Parameters

SEQUENCES	16	16		
PERMISSIVES	NO	NO	NO	NO
OVERLAPS	YES	YES	YES	YES
CYCLES	60	120	10	
GREENTIMES	17.00	3.00	2.00	23.00
YELLOWTIMES	5.00	5.00	0.00	5.00
CRITICALS	3	12	0	5
EXCESS	0			

LEADLAGS	NONE	NONE
OFFSET	0.00	1
PEDTIME	0.0	0

Institute for Astronomy
PM Peak Hour of Traffic
Existing

12/23/03
10:35:56

SIGNAL2000/TEAPAC[Ver 1.11.00] - Capacity Analysis Summary

Intersection Averages for Int # 0 - Haleakala Highway/Makawao Aven
Degree of Saturation (v/c) 0.56 Vehicle Delay 22.6 Level of Service C+

```
Sq 16 |  Phase 1   |  Phase 2   |  Phase 3   |  Phase 4   |
**/** --------------------------------------------------------
      | + + *      | +          | +          |        ^   |
      | + + *      | +          | +          |       ++++|
 /|\  |<+ + *>     |<+          |<+          |      <****|
  |   |   v        |    ^   ****|    ^       |            |
  |   |      ^     |++++    v   |****        |            |
North |   <+ + +>  |          +>|++++>       |++++>       |
  |   |    + + +   |          + |++++        |++++        |
      |    + + +   |          + |    v       |    v       |
      --------------------------------------------------------
      | G/C=0.300  | G/C=0.050  | G/C=0.050  | G/C=0.267  |
      | G= 18.0"   | G=  3.0"   | G=  3.0"   | G= 16.0"   |
      | Y+R= 5.0"  | Y+R= 5.0"  | Y+R= 5.0"  | Y+R= 5.0"  |
      | OFF= 0.0%  | OFF=38.3%  | OFF=51.7%  | OFF=65.0%  |
      --------------------------------------------------------
      C= 60 sec   G= 40.0 sec = 66.7%  Y=20.0 sec = 33.3%  Ped= 0.0 sec =  0.0%
```

Lane Group	Width/ Lanes	g/C Reqd	g/C Used	Service Rate @C (vph)	Service Rate @E	Adj Volume	v/c	HCM Delay	L S	Queue Model 1
SB Approach								19.0	B	
RT	12/1	0.168	0.567	866	897	172	0.192	6.8	A	75 ft
TH	12/1	0.210	0.300	492	559	319	0.571	19.1	B	216 ft
LT	12/1	0.300	0.300	126	164	126	0.746	35.4	*D+	106 ft
NB Approach								22.7	C+	
RT	12/1	0.047	0.433	629	686	18	0.026	9.8	A	10 ft
TH	12/1	0.260	0.300	492	559	413	0.739	24.1	C+	306 ft
LT	12/1	0.000	0.300	195	246	46	0.187	15.9	B	28 ft
WB Approach								28.0	C	
RT	12/1	0.190	0.267	332	422	207	0.491	23.4	C+	157 ft
TH	12/1	0.253	0.267	423	497	397	0.799	30.4	*C	323 ft
LT	12/1	0.017	0.050	49	76	9	0.102	27.7	*C	7 ft
EB Approach								20.5	C+	
RT	12/1	0.077	0.400	570	633	46	0.073	11.3	B+	26 ft
TH	24/2	0.109	0.400	1375	1416	296	0.209	11.9	B+	81 ft
LT	12/1	0.178	0.183	253	324	244	0.753	32.8	*C	201 ft

Institute for Astronomy
PM Peak Hour of Traffic
Existing

12/23/03
10:37:08

SIGNAL2000/TEAPAC[Ver 1.11.00] - Summary of Parameter Values

```
   Intersection Parameters for Int #   0 - Haleakala Highway/Makawao Aven
METROAREA            NONCBD
SIMULATION PERIOD        15
LEVELOFSERVICE      C     S
NODELOCATION        0     0
QUEUEMODELS   1  90  25  40

   Approach Parameters
APPLABELS              SB            WB            NB            EB
GRADES                0.0           0.0           0.0           0.0
PEDLEVELS               0             0             0             0
BIKEVOLUMES             0             0             0             0
PARKINGSIDES         NONE          NONE          NONE          NONE
PARKVOLUMES            20            20            20            20
BUSVOLUMES              0             0             0             0
RIGHTTURNONREDS         0             0             0             0
UPSTREAMVC           0.00          0.00          0.00          0.00

   Movement Parameters
MOVLABELS          RT   TH   LT    RT   TH   LT    RT   TH   LT    RT   TH   LT
VOLUMES           155  287  113   186  357    8    16  372   41    41  266  220
WIDTHS           12.0 12.0 12.0  12.0 12.0 12.0  12.0 12.0 12.0  12.0 24.0 12.0
LANES               1    1    1     1    1    1     1    1    1     1    2    1
GROUPTYPES       NORM NORM NORM  NORM NORM NORM  NORM NORM NORM  NORM NORM NORM
UTILIZATIONS     0.00 0.00 0.00  0.00 0.00 0.00  0.00 0.00 0.00  0.00 0.00 0.00
TRUCKPERCENTS     2.0  2.0  2.0   2.0  2.0  2.0   2.0  2.0  2.0   2.0  2.0  2.0
PEAKHOURFACTORS  0.90 0.90 0.90  0.90 0.90 0.90  0.90 0.90 0.90  0.90 0.90 0.90
ARRIVALTYPES        3    3    3     2    2    2     3    3    3     3    3    3
ACTUATIONS         NO  YES  YES    NO  YES  YES    NO  YES  YES    NO  YES  YES
REQCLEARANCES     5.0  5.0  5.0   5.0  5.0  5.0   5.0  5.0  5.0   5.0  5.0  5.0
MINIMUMS          5.0  5.0  5.0   5.0  5.0  5.0   5.0  5.0  5.0   5.0  5.0  5.0
STARTUPLOST       2.0  2.0  2.0   2.0  2.0  2.0   2.0  2.0  2.0   2.0  2.0  2.0
ENDGAIN           2.0  2.0  2.0   2.0  2.0  2.0   2.0  2.0  2.0   2.0  2.0  2.0
STORAGE             0    0    0     0    0    0     0    0    0     0    0    0
INITIALQUEUE        0    0    0     0    0    0     0    0    0     0    0    0
IDEALSATFLOWS    1900 1900 1900  1900 1900 1900  1900 1900 1900  1900 1900 1900
FACTORS          1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00
DELAYFACTORS     1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00
NSTOPFACTORS     1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00
SATURATIONFLOWS  1583 1863  565  1583 1863 1770  1583 1863  819  1583 3539 1770

   Phasing Parameters
SEQUENCES          16    16
PERMISSIVES        NO    NO    NO    NO        LEADLAGS      NONE   NONE
OVERLAPS          YES   YES   YES   YES        OFFSET        0.00      1
CYCLES             60   120    10              PEDTIME        0.0      0
GREENTIMES      18.00  3.00  3.00 16.00
YELLOWTIMES      5.00  5.00  5.00  5.00
CRITICALS           3     6    12     5
EXCESS              0
```

Institute for Astronomy
AM Peak Hour of Traffic
Existing

12/24/03
10:41:52

SIGNAL2000/TEAPAC[Ver 1.11.00] - Capacity Analysis Summary

```
Intersection Averages for Int #   0 - Kula Highway/Haleakala Highway
     Degree of Saturation (v/c) 0.70  Vehicle Delay  24.4  Level of Service C+

       -------------------------------------------------------
Sq 61  |  Phase 1   |  Phase 2   |  Phase 3   |  Phase 4   |
**/**  -------------------------------------------------------
       |     *      |            | + +        |            |
       |     *      |            | + +        |            |
 /|\   |     *>     |            |<+ +        |       <****|
  |    |            |            |    v       |   ^    ****|
  |    |            |          ^ |          ^ |++++    v   |
North  |    <+      |       <* + |          * |++++>       |
  |    |     +      |        * + |          * |            |
       |     +      |        * + |          * |            |
       -------------------------------------------------------
       | G/C=0.083  | G/C=0.017  | G/C=0.350  | G/C=0.217  |
       | G=   5.0"  | G=   1.0"  | G=  21.0"  | G=  13.0"  |
       | Y+R= 5.0"  | Y+R= 5.0"  | Y+R= 5.0"  | Y+R= 5.0"  |
       | OFF= 0.0%  | OFF=16.7%  | OFF=26.7%  | OFF=70.0%  |
       -------------------------------------------------------
       C= 60 sec   G= 40.0 sec = 66.7%  Y=20.0 sec = 33.3%  Ped= 0.0 sec =  0.0%

-----------------------------------------------------------------------------------------
| Lane   |Width/|    g/C      | Service Rate|  Adj  |       |  HCM  | L | Queue  |
| Group  | Lanes| Reqd   Used | @C (vph) @E |Volume|  v/c  | Delay | S |Model 1|
-----------------------------------------------------------------------------------------

SB Approach                                                     19.5    B
=========================================================================================
|  RT    | 12/1 |0.012 |0.350 |  472 |  554 |     1 |0.002 |  13.9 | B+|    1 ft|
|  TH    | 12/1 |0.220 |0.350 |  583 |  652 |   336 |0.515 |  17.7 | B |  230 ft|
|  LT    | 12/1 |0.065 |0.083 |   93 |  137 |    68 |0.463 |  28.5 |*C |   56 ft|
-----------------------------------------------------------------------------------------

NB Approach                                                     25.5    C+
=========================================================================================
|  TH    | 12/1 |0.412 |0.450 |  793 |  838 |   716 |0.854 |  23.4 |*C+|  534 ft|
|  LT    | 12/1 |0.175 |0.183 |  253 |  324 |   240 |0.741 |  31.9 |*C |  196 ft|
-----------------------------------------------------------------------------------------

WB Approach                                                     31.6    C
=========================================================================================
|  TH+LT | 12/1 |0.207 |0.217 |  230 |  294 |   218 |0.741 |  31.6 |*C |  178 ft|
-----------------------------------------------------------------------------------------

EB Approach                                                     21.2    C+
=========================================================================================
|  TH+LT | 12/1 |0.133 |0.217 |  331 |  403 |   179 |0.444 |  21.2 | C+|  125 ft|
-----------------------------------------------------------------------------------------
```

Institute for Astronomy
AM Peak Hour of Traffic
Existing

12/24/03
10:41:45

SIGNAL2000/TEAPAC[Ver 1.11.00] - Summary of Parameter Values

Intersection Parameters for Int # 0 - Kula Highway/Haleakala Highway

METROAREA	NONCBD			
SIMULATION PERIOD	15			
LEVELOFSERVICE	C	S		
NODELOCATION	0	0		
QUEUEMODELS	1	90	25	40

Approach Parameters

APPLABELS	SB	WB	NB	EB
GRADES	0.0	0.0	0.0	0.0
PEDLEVELS	0	0	0	0
BIKEVOLUMES	0	0	0	0
PARKINGSIDES	NONE	NONE	NONE	NONE
PARKVOLUMES	20	20	20	20
BUSVOLUMES	0	0	0	0
RIGHTTURNONREDS	0	0	0	0
UPSTREAMVC	0.00	0.00	0.00	0.00

Movement Parameters

MOVLABELS	RT	TH	LT	RT	TH	LT	RT	TH	LT	RT	TH	LT
VOLUMES	1	302	61	161	95	101	108	644	216	420	160	1
WIDTHS	12.0	12.0	12.0	12.0	12.0	0.0	12.0	12.0	12.0	12.0	12.0	0.0
LANES	1	1	1	1	1	0	1	1	1	1	1	0
GROUPTYPES	NORM	NORM	NORM	FFLW	NORM	NORM	FFLW	NORM	NORM	FFLW	NORM	NORM
UTILIZATIONS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRUCKPERCENTS	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
PEAKHOURFACTORS	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
ARRIVALTYPES	2	2	2	3	3	3	3	3	3	3	3	3
ACTUATIONS	NO	YES	YES	NO	YES	YES	NO	YES	YES	NO	YES	YES
REQCLEARANCES	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
MINIMUMS	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
STARTUPLOST	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
ENDGAIN	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
STORAGE	0	0	0	0	0	0	0	0	0	0	0	0
INITIALQUEUE	0	0	0	0	0	0	0	0	0	0	0	0
IDEALSATFLOWS	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
FACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
DELAYFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
NSTOPFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
SATURATIONFLOWS	1583	1863	1770	0	1359	0	0	1863	1770	0	1859	0

Phasing Parameters

SEQUENCES	61	61					
PERMISSIVES	NO	NO	NO	NO	LEADLAGS	NONE	NONE
OVERLAPS	YES	YES	YES	YES	OFFSET	0.00	1
CYCLES	60	180	10		PEDTIME	0.0	0
GREENTIMES	5.00	1.00	21.00	13.00			
YELLOWTIMES	5.00	5.00	5.00	5.00			
CRITICALS	3	9	8	5			
EXCESS	0						

Institute for Astronomy
PM Peak Hour of Traffic
Existing

12/24/03
10:46:04

SIGNAL2000/TEAPAC[Ver 1.11.00] - Capacity Analysis Summary

Intersection Averages for Int # 0 - Kula Highway/Haleakala Highway
Degree of Saturation (v/c) 0.56 Vehicle Delay 18.1 Level of Service B

```
       ------------------------------------------------------
Sq 61 |  Phase 1   |  Phase 2   |  Phase 3   |  Phase 4   |
**/** ------------------------------------------------------
      |     *      |            | + *        |            |
      |     *      |            | + *        |            |
 /|\  |     *>     |            |<+ *        |     <****|
  |   |            |            |   v        |   ^   ****|
  |   |            |        ^   |        ^   |++++   v    |
North |    <+      |     <* +   |        +   |++++>       |
  |   |     +      |      * +   |        +   |            |
      |     +      |      * +   |        +   |            |
       ------------------------------------------------------
      | G/C=0.117  | G/C=0.033  | G/C=0.367  | G/C=0.150  |
      | G=   7.0"  | G=   2.0"  | G=  22.0"  | G=   9.0"  |
      | Y+R= 5.0"  | Y+R= 5.0"  | Y+R= 5.0"  | Y+R= 5.0"  |
      | OFF= 0.0%  | OFF=20.0%  | OFF=31.7%  | OFF=76.7%  |
       ------------------------------------------------------
       C= 60 sec   G= 40.0 sec = 66.7%  Y=20.0 sec = 33.3%  Ped= 0.0 sec =  0.0%
```

Lane Group	Width/ Lanes	g/C Reqd	g/C Used	Service Rate @C (vph)	Service Rate @E	Adj Volume	v/c	HCM Delay	L S	Queue Model 1
SB Approach								19.0	B	
RT	12/1	0.012	0.367	501	581	1	0.002	13.4	B+	1 ft
TH	12/1	0.254	0.367	616	683	398	0.583	18.3	*B	275 ft
LT	12/1	0.055	0.117	143	200	54	0.262	24.8	*C+	42 ft
NB Approach								16.3	B	
TH	12/1	0.323	0.483	861	900	537	0.597	12.3	B+	307 ft
LT	12/1	0.192	0.233	343	413	268	0.649	24.3	*C+	200 ft
WB Approach								24.7	C+	
TH+LT	12/1	0.105	0.150	167	227	105	0.457	24.7	*C+	80 ft
EB Approach								23.0	C+	
TH+LT	12/1	0.063	0.150	208	278	69	0.248	23.0	C+	49 ft

Institute for Astronomy
PM Peak Hour of Traffic
Existing

12/24/03
10:43:00

SIGNAL2000/TEAPAC[Ver 1.11.00] - Summary of Parameter Values

Intersection Parameters for Int # 0 - Kula Highway/Haleakala Highway

METROAREA	NONCBD			
SIMULATION PERIOD	15			
LEVELOFSERVICE	C	S		
NODELOCATION	0	0		
QUEUEMODELS	1	90	25	40

Approach Parameters

	SB	WB	NB	EB
APPLABELS	SB	WB	NB	EB
GRADES	0.0	0.0	0.0	0.0
PEDLEVELS	0	0	0	0
BIKEVOLUMES	0	0	0	0
PARKINGSIDES	NONE	NONE	NONE	NONE
PARKVOLUMES	20	20	20	20
BUSVOLUMES	0	0	0	0
RIGHTTURNONREDS	0	0	0	0
UPSTREAMVC	0.00	0.00	0.00	0.00

Movement Parameters

MOVLABELS	RT	TH	LT	RT	TH	LT	RT	TH	LT	RT	TH	LT
VOLUMES	1	358	49	77	52	42	35	483	241	207	61	1
WIDTHS	12.0	12.0	12.0	12.0	12.0	0.0	12.0	12.0	12.0	12.0	12.0	0.0
LANES	1	1	1	1	1	0	1	1	1	1	1	0
GROUPTYPES	NORM	NORM	NORM	FFLW	NORM	NORM	FFLW	NORM	NORM	FFLW	NORM	NORM
UTILIZATIONS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRUCKPERCENTS	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
PEAKHOURFACTORS	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
ARRIVALTYPES	2	2	2	3	3	3	3	3	3	3	3	3
ACTUATIONS	NO	YES	YES	NO	YES	YES	NO	YES	YES	NO	YES	YES
REQCLEARANCES	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
MINIMUMS	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
STARTUPLOST	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
ENDGAIN	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
STORAGE	0	0	0	0	0	0	0	0	0	0	0	0
INITIALQUEUE	0	0	0	0	0	0	0	0	0	0	0	0
IDEALSATFLOWS	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
FACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
DELAYFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
NSTOPFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
SATURATIONFLOWS	1583	1863	1770	0	1533	0	0	1863	1770	0	1854	0

Phasing Parameters

SEQUENCES	61	61		
PERMISSIVES	NO	NO	NO	NO
OVERLAPS	YES	YES	YES	YES
CYCLES	60	180	10	
GREENTIMES	7.00	2.00	22.00	9.00
YELLOWTIMES	5.00	5.00	5.00	5.00
CRITICALS	3	9	2	5
EXCESS	0			

LEADLAGS	NONE	NONE
OFFSET	0.00	1
PEDTIME	0.0	0

Institute for Astronomy
AM Peak Hour of Traffic
Existing

12/23/03
10:39:16

SIGNAL2000/TEAPAC[Ver 1.11.00] - Capacity Analysis Summary

Intersection Averages for Int # 0 - Old Haleakala Hwy/Pukalani St
Degree of Saturation (v/c) 0.60 Vehicle Delay 20.2 Level of Service C+

```
Sq  0 |  Phase 1  |  Phase 2  |  Phase 3  |
**/** -------------------------------------
      |           |           |           |
 /|\  |           |     <++++|      <++++|
  |   |           |      ****|       ++++|
  |   |           |      v   |       v    |
North |     <+   +>|        +>|++++>       |
  |   |++++ +    * |        + |++++       |
      |  v +     * |        + |   v       |
      -------------------------------------
      | G/C=0.400 | G/C=0.083 | G/C=0.350 |
      | G= 24.0"  | G=  5.0"  | G= 21.0"  |
      | Y+R= 5.0" | Y+R= 5.0" | Y+R= 0.0" |
      | OFF= 0.0% | OFF=48.3% | OFF=65.0% |
      -------------------------------------
C= 60 sec   G= 50.0 sec = 83.3%   Y=10.0 sec = 16.7%   Ped= 0.0 sec = 0.0%
```

Lane Group	Width/ Lanes	g/C Reqd	g/C Used	Service Rate @C (vph)	Service Rate @E	Adj Volume	v/c	HCM Delay	L S	Queue Model 1
NB Approach								22.1	C+	
RT	12/1	0.195	0.567	866	897	217	0.242	7.2	*A	96 ft
LT	12/1	0.378	0.400	655	708	612	0.864	27.4	C+	480 ft
WB Approach								24.3	C+	
TH	12/1	0.147	0.433	759	807	203	0.252	11.0	B+	103 ft
LT	12/1	0.081	0.083	308	354	303	0.856	33.2	*C	256 ft
EB Approach								13.7	B+	
RT	12/1	0.206	0.750	1188	1188	234	0.197	2.6	A	66 ft
TH	12/1	0.207	0.267	427	497	314	0.632	22.0	C+	225 ft

Institute for Astronomy
AM Peak Hour of Traffic
Existing

12/23/03
10:39:23

SIGNAL2000/TEAPAC[Ver 1.11.00] - Summary of Parameter Values

Intersection Parameters for Int # 0 - Old Haleakala Hwy/Pukalani St

METROAREA	NONCBD			
SIMULATION PERIOD	15			
LEVELOFSERVICE	C	S		
NODELOCATION	0	0		
QUEUEMODELS	1	90	25	40

Approach Parameters

APPLABELS	SB	WB	NB	EB
GRADES	0.0	0.0	0.0	0.0
PEDLEVELS	0	0	0	0
BIKEVOLUMES	0	0	0	0
PARKINGSIDES	NONE	NONE	NONE	NONE
PARKVOLUMES	20	20	20	20
BUSVOLUMES	0	0	0	0
RIGHTTURNONREDS	0	0	0	0
UPSTREAMVC	0.00	0.00	0.00	0.00

Movement Parameters

MOVLABELS	RT	TH	LT	RT	TH	LT	RT	TH	LT	RT	TH	LT
VOLUMES	0	0	0	0	183	273	195	0	551	211	283	0
WIDTHS	0.0	0.0	0.0	0.0	12.0	12.0	12.0	0.0	12.0	12.0	12.0	0.0
LANES	0	0	0	0	1	1	1	0	1	1	1	0
GROUPTYPES	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM
UTILIZATIONS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRUCKPERCENTS	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
PEAKHOURFACTORS	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
ARRIVALTYPES	3	3	3	3	3	3	3	3	3	3	3	3
ACTUATIONS	NO	YES	YES	NO	YES	YES	NO	YES	YES	NO	YES	YES
REQCLEARANCES	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
MINIMUMS	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
STARTUPLOST	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
ENDGAIN	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
STORAGE	0	0	0	0	0	0	0	0	0	0	0	0
INITIALQUEUE	0	0	0	0	0	0	0	0	0	0	0	0
IDEALSATFLOWS	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
FACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
DELAYFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
NSTOPFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
SATURATIONFLOWS	0	0	0	0	1863	1770	1583	0	1770	1583	1863	0

Institute for Astronomy
AM Peak Hour of Traffic
Existing

12/23/03
10:39:23

SIGNAL2000/TEAPAC[Ver 1.11.00] - Summary of Parameter Values

Phasing Parameters

SEQUENCES	0	0					
PERMISSIVES	YES	YES	YES	YES			
OVERLAPS	YES	YES	YES	YES			
CYCLES	60	120	10				
GREENTIMES	24.00	5.00	21.00				
YELLOWTIMES	5.00	5.00	0.00				
CRITICALS	7	6	2				
EXCESS	0						
PHASEMOVEMENTS	1	7	9	10	0	0	0
PHASEMOVEMENTS	2	6	7	5	0	0	0
PHASEMOVEMENTS	3	5	10	11	-6	0	0
PHASEMOVEMENTS	4	0	0	0	0	0	0
PHASEMOVEMENTS	5	0	0	0	0	0	0
PHASEMOVEMENTS	6	0	0	0	0	0	0

LEADLAGS	NONE	NONE
OFFSET	0.00	1
PEDTIME	0.0	0

Institute for Astronomy   12/23/03
PM Peak Hour of Traffic   10:40:03
Existing

SIGNAL2000/TEAPAC[Ver 1.11.00] - Capacity Analysis Summary

Intersection Averages for Int # 0 - Old Haleakala Hwy/Pukalani St
Degree of Saturation (v/c) 0.45 Vehicle Delay 10.7 Level of Service B+

```
      ---------------------------------------
Sq  0 |  Phase 1  |  Phase 2  |  Phase 3  |
**/** ---------------------------------------
      |           |           |           |
  .   |           |           |           |
 /|\  |           |     <++++|     <++++|
  |   |           |      ****|      ++++|
  |   |           |     v    |     v    |
North |    <+   *>|        +>|++++>     |
  |   |++++ +   * |        + |++++      |
      |   v +   * |        + |   v      |
      ---------------------------------------
      | G/C=0.333 | G/C=0.083 | G/C=0.417 |
      | G=  20.0" | G=   5.0" | G=  25.0" |
      | Y+R= 5.0" | Y+R= 5.0" | Y+R= 0.0" |
      | OFF= 0.0% | OFF=41.7% | OFF=58.3% |
      ---------------------------------------
      C= 60 sec   G= 50.0 sec = 83.3%  Y=10.0 sec = 16.7%  Ped= 0.0 sec =  0.0%
```

Lane Group	Width/ Lanes	g/C Reqd	g/C Used	Service Rate @C (vph)	Service Rate @E	Adj Volume	v/c	HCM Delay	L S	Queue Model 1
NB Approach								13.8	B+	
RT	12/1	0.266	0.500	748	792	336	0.424	11.2	*B+	178 ft
LT	12/1	0.209	0.333	528	590	298	0.505	16.7	B	191 ft
WB Approach								12.1	B+	
TH	12/1	0.103	0.500	895	931	129	0.139	8.1	A	56 ft
LT	12/1	0.003	0.083	517	560	362	0.646	13.5	*B+	222 ft
EB Approach								6.8	A	
RT	12/1	0.357	0.750	1188	1188	494	0.416	3.8	A	162 ft
TH	12/1	0.132	0.333	558	621	178	0.287	15.0	B+	104 ft

Institute for Astronomy   12/23/03
PM Peak Hour of Traffic   10:40:09
Existing

SIGNAL2000/TEAPAC[Ver 1.11.00] - Summary of Parameter Values

Intersection Parameters for Int # 0 - Old Haleakala Hwy/Pukalani St

METROAREA	NONCBD			
SIMULATION PERIOD	15			
LEVELOFSERVICE	C	8		
NODELOCATION	0	0		
QUEUEMODELS	1	90	25	40

Approach Parameters

APPLABELS	SB	WB	NB	EB
GRADES	0.0	0.0	0.0	0.0
PEDLEVELS	0	0	0	0
BIKEVOLUMES	0	0	0	0
PARKINGSIDES	NONE	NONE	NONE	NONE
PARKVOLUMES	20	20	20	20
BUSVOLUMES	0	0	0	0
RIGHTTURNONREDS	0	0	0	0
UPSTREAMVC	0.00	0.00	0.00	0.00

Movement Parameters

MOVLABELS	RT	TH	LT	RT	TH	LT	RT	TH	LT	RT	TH	LT
VOLUMES	0	0	0	0	116	326	302	0	268	445	160	0
WIDTHS	0.0	0.0	0.0	0.0	12.0	12.0	12.0	0.0	12.0	12.0	12.0	0.0
LANES	0	0	0	0	1	1	1	0	1	1	1	0
GROUPTYPES	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM
UTILIZATIONS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRUCKPERCENTS	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
PEAKHOURFACTORS	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
ARRIVALTYPES	3	3	3	3	3	3	3	3	3	3	3	3
ACTUATIONS	NO	YES	YES	NO	YES	YES	NO	YES	YES	NO	YES	YES
REQCLEARANCES	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
MINIMUMS	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
STARTUPLOST	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
ENDGAIN	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
STORAGE	0	0	0	0	0	0	0	0	0	0	0	0
INITIALQUEUE	0	0	0	0	0	0	0	0	0	0	0	0
IDEALSATFLOWS	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
FACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
DELAYFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
NSTOPFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
SATURATIONFLOWS	0	0	0	0	1863	1770	1583	0	1770	1583	1863	0

Institute for Astronomy
PM Peak Hour of Traffic
Existing

12/23/03
10:40:09

SIGNAL2000/TEAPAC[Ver 1.11.00] - Summary of Parameter Values

Phasing Parameters							
SEQUENCES	0	0					
PERMISSIVES	YES	YES	YES	YES			
OVERLAPS	YES	YES	YES	YES			
CYCLES	60	120	10				
GREENTIMES	20.00	5.00	25.00				
YELLOWTIMES	5.00	5.00	0.00				
CRITICALS	7	6	2				
EXCESS	0						
PHASEMOVEMENTS	1	7	9	10	0	0	0
PHASEMOVEMENTS	2	6	7	5	0	0	0
PHASEMOVEMENTS	3	5	10	11	-6	0	0
PHASEMOVEMENTS	4	0	0	0	0	0	0
PHASEMOVEMENTS	5	0	0	0	0	0	0
PHASEMOVEMENTS	6	0	0	0	0	0	0

LEADLAGS	NONE	NONE
OFFSET	0.00	1
PEDTIME	0.0	0

Institute for Astronomy
AM Peak Hour of Traffic
Existing

12/23/03
10:38:18

SIGNAL2000/TEAPAC[Ver 1.11.00] - Capacity Analysis Summary

Intersection Averages for Int # 0 - Old Haleakala Highway/Makawao
Degree of Saturation (v/c) 0.46 Vehicle Delay 14.1 Level of Service B+

```
        --------------------------------------
Sq  0 |  Phase 1  |  Phase 2  |  Phase 3  |
**/** --------------------------------------
      | + * *     |           |        ^  |
      | + * *     |           |       ****|
 /|\  |<+ * *>    |           |      <****|
  |   |   v       |    ^      |    ^  ****|
  |   |       ^   |++++       |++++   v   |
North |    <+ + +>|++++>      |++++>      |
  |   |     + + + |++++       |++++       |
      |     + + + |    v      |    v      |
      --------------------------------------
      | G/C=0.300 | G/C=0.050 | G/C=0.400 |
      | G=  18.0" | G=   3.0" | G=  24.0" |
      | Y+R= 5.0" | Y+R= 5.0" | Y+R= 5.0" |
      | OFF= 0.0% | OFF=38.3% | OFF=51.7% |
      --------------------------------------
      C= 60 sec   G= 45.0 sec = 75.0%  Y=15.0 sec = 25.0%  Ped= 0.0 sec =  0.0%
```

Lane Group	Width/ Lanes	g/C Reqd	g/C Used	Service Rate @C (vph)	Service Rate @E	Adj Volume	v/c	HCM Delay	L S	Queue Model 1
SB Approach								19.4	B	
RT	12/1	0.204	0.300	395	475	231	0.486	20.7	C+	160 ft
TH+LT	12/1	0.105	0.300	355	417	94	0.225	16.0	*B	57 ft
NB Approach								19.2	B	
RT+TH+LT	12/1	0.212	0.300	429	494	280	0.567	19.2	B	191 ft
WB Approach								15.1	B	
RT+TH+LT	12/1	0.268	0.400	588	642	362	0.564	15.1	*B	225 ft
EB Approach								8.6	A	
RT+TH	12/1	0.287	0.533	957	987	462	0.468	9.1	A	227 ft
LT	12/1	0.140	0.533	913	944	181	0.192	7.4	A	76 ft

Institute for Astronomy
AM Peak Hour of Traffic
Existing

12/23/03
10:38:26

SIGNAL2000/TEAPAC[Ver 1.11.00] - Summary of Parameter Values

Intersection Parameters for Int # 0 - Old Haleakala Highway/Makawao

METROAREA	NONCBD			
SIMULATION PERIOD	15			
LEVELOFSERVICE	C	S		
NODELOCATION	0	0		
QUEUEMODELS	1	90	25	40

Approach Parameters

APPLABELS	SB	WB	NB	EB
GRADES	0.0	0.0	0.0	0.0
PEDLEVELS	0	0	0	0
BIKEVOLUMES	0	0	0	0
PARKINGSIDES	NONE	NONE	NONE	NONE
PARKVOLUMES	20	20	20	20
BUSVOLUMES	0	0	0	0
RIGHTTURNONREDS	0	0	0	0
UPSTREAMVC	0.00	0.00	0.00	0.00

Movement Parameters

MOVLABELS	RT	TH	LT	RT	TH	LT	RT	TH	LT	RT	TH	LT
VOLUMES	208	36	49	59	218	49	150	74	28	19	397	163
WIDTHS	12.0	12.0	0.0	0.0	12.0	0.0	0.0	12.0	0.0	0.0	12.0	12.0
LANES	1	1	0	0	1	0	0	1	0	0	1	1
GROUPTYPES	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM
UTILIZATIONS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRUCKPERCENTS	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
PEAKHOURFACTORS	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
ARRIVALTYPES	3	3	3	3	3	3	3	3	3	3	3	3
ACTUATIONS	NO	YES	YES	NO	YES	YES	NO	YES	YES	NO	YES	YES
REQCLEARANCES	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
MINIMUMS	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
STARTUPLOST	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
ENDGAIN	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
STORAGE	0	0	0	0	0	0	0	0	0	0	0	0
INITIALQUEUE	0	0	0	0	0	0	0	0	0	0	0	0
IDEALSATFLOWS	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
FACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
DELAYFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
NSTOPFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
SATURATIONFLOWS	1583	1391	0	0	1605	0	0	1646	0	0	1850	1770

Institute for Astronomy
AM Peak Hour of Traffic
Existing

12/23/03
10:38:26

SIGNAL2000/TEAPAC[Ver 1.11.00] - Summary of Parameter Values

Phasing Parameters

SEQUENCES	0	0					
PERMISSIVES	NO	NO	NO	NO			
OVERLAPS	YES	YES	YES	YES			
CYCLES	60	120	10				
GREENTIMES	18.00	3.00	24.00				
YELLOWTIMES	5.00	5.00	5.00				
CRITICALS	2	6	5				
EXCESS	0						
PHASEMOVEMENTS	1	1	2	3	7	8	9
PHASEMOVEMENTS	2	10	11	12	0	0	0
PHASEMOVEMENTS	3	4	5	6	10	11	12
PHASEMOVEMENTS	4	0	0	0	0	0	0
PHASEMOVEMENTS	5	0	0	0	0	0	0
PHASEMOVEMENTS	6	0	0	0	0	0	0

LEADLAGS	NONE	NONE
OFFSET	0.00	1
PEDTIME	0.0	0

Institute for Astronomy
PM Peak Hour of Traffic
Existing

12/23/03
10:38:47

SIGNAL2000/TEAPAC[Ver 1.11.00] - Capacity Analysis Summary

Intersection Averages for Int # 0 - Old Haleakala Highway/Makawao
Degree of Saturation (v/c) 0.40 Vehicle Delay 13.9 Level of Service B+

```
        -------------------------------------
Sq  0 |  Phase 1  |  Phase 2  |  Phase 3  |
**/** -------------------------------------
      | + * *     |           |         ^ |
      | + * *     |           |      ****|
 /|\  |<+ * *>    |           |     <****|
  |   |   v       |     ^     |   ^  ****|
  |   |        ^  |++++       |++++  v   |
North |     <+ + +>|++++>      |++++>      |
  |   |      + + + |++++       |++++       |
      |      + + + |    v      |   v       |
      -------------------------------------
      | G/C=0.300 | G/C=0.050 | G/C=0.400 |
      | G=  18.0" | G=   3.0" | G=  24.0" |
      | Y+R= 5.0" | Y+R= 5.0" | Y+R= 5.0" |
      | OFF= 0.0% | OFF=38.3% | OFF=51.7% |
      -------------------------------------
      C= 60 sec   G= 45.0 sec = 75.0%  Y=15.0 sec = 25.0%  Ped= 0.0 sec =  0.0%
```

Lane Group	Width/ Lanes	g/C Reqd	g/C Used	Service Rate @C (vph)	Service Rate @E	Adj Volume	v/c	HCM Delay	L S	Queue Model 1
SB Approach								21.8	C+	
RT	12/1	0.241	0.300	395	475	293	0.617	23.9	C+	213 ft
TH+LT	12/1	0.105	0.300	406	470	108	0.230	16.0	*B	65 ft
NB Approach								16.0	B	
RT+TH+LT	12/1	0.102	0.300	447	512	115	0.225	16.0	B	69 ft
WB Approach								14.0	B+	
RT+TH+LT	12/1	0.236	0.400	628	682	332	0.487	14.0	*B+	197 ft
EB Approach								8.0	A	
RT+TH	12/1	0.179	0.533	945	975	255	0.262	7.7	A	111 ft
LT	12/1	0.229	0.533	913	944	333	0.353	8.3	A	153 ft

Institute for Astronomy
PM Peak Hour of Traffic
Existing

12/23/03
10:38:54

SIGNAL2000/TEAPAC[Ver 1.11.00] - Summary of Parameter Values

Intersection Parameters for Int # 0 - Old Haleakala Highway/Makawao

METROAREA	NONCBD			
SIMULATION PERIOD	15			
LEVELOFSERVICE	C	S		
NODELOCATION	0	0		
QUEUEMODELS	1	90	25	40

Approach Parameters

APPLABELS	SB	WB	NB	EB
GRADES	0.0	0.0	0.0	0.0
PEDLEVELS	0	0	0	0
BIKEVOLUMES	0	0	0	0
PARKINGSIDES	NONE	NONE	NONE	NONE
PARKVOLUMES	20	20	20	20
BUSVOLUMES	0	0	0	0
RIGHTTURNONREDS	0	0	0	0
UPSTREAMVC	0.00	0.00	0.00	0.00

Movement Parameters

MOVLABELS	RT	TH	LT	RT	TH	LT	RT	TH	LT	RT	TH	LT
VOLUMES	264	54	43	60	203	35	27	59	17	28	202	300
WIDTHS	12.0	12.0	0.0	0.0	12.0	0.0	0.0	12.0	0.0	0.0	12.0	12.0
LANES	1	1	0	0	1	0	0	1	0	0	1	1
GROUPTYPES	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM
UTILIZATIONS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRUCKPERCENTS	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
PEAKHOURFACTORS	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
ARRIVALTYPES	3	3	3	3	3	3	3	3	3	3	3	3
ACTUATIONS	NO	YES	YES	NO	YES	YES	NO	YES	YES	NO	YES	YES
REQCLEARANCES	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
MINIMUMS	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
STARTUPLOST	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
ENDGAIN	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
STORAGE	0	0	0	0	0	0	0	0	0	0	0	0
INITIALQUEUE	0	0	0	0	0	0	0	0	0	0	0	0
IDEALSATFLOWS	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
FACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
DELAYFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
NSTOPFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
SATURATIONFLOWS	1583	1566	0	0	1705	0	0	1706	0	0	1829	1770

Institute for Astronomy
PM Peak Hour of Traffic
Existing

12/23/03
10:38:54

SIGNAL2000/TEAPAC[Ver 1.11.00] - Summary of Parameter Values

Phasing Parameters							
SEQUENCES	0	0					
PERMISSIVES	NO	NO	NO	NO			
OVERLAPS	YES	YES	YES	YES			
CYCLES	60	120	10				
GREENTIMES	18.00	3.00	24.00				
YELLOWTIMES	5.00	5.00	5.00				
CRITICALS	2	6	5				
EXCESS	0						
PHASEMOVEMENTS	1	1	2	3	7	8	9
PHASEMOVEMENTS	2	10	11	12	0	0	0
PHASEMOVEMENTS	3	4	5	6	10	11	12
PHASEMOVEMENTS	4	0	0	0	0	0	0
PHASEMOVEMENTS	5	0	0	0	0	0	0
PHASEMOVEMENTS	6	0	0	0	0	0	0

LEADLAGS	NONE	NONE
OFFSET	0.00	1
PEDTIME	0.0	0

CHAPTER 17 - TWSC - UNSIGNALIZED INTERSECTIONS WORKSHEET

Analysis Summary

General Information		Site Information	
Analyst	TL	Jurisdiction/Date	KULA, MAUI 12/23/200
Agency or Company	ATA	Major Street	KULA HWY
Analysis Period/Year	AM PEAK HOUR 2003	Minor Street	KKHS DRWY
Comment	EXISTING		

Input Data

	SB			NB			EB			WB		
Lane Configuration												
Lane 1 (curb)	TR			R			LTR			R		
Lane 2	L			LT						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)	231	570	1	0	830	131	2	1	2	18		125
PHF	.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
Flow rate	257	633	1	0	922	146	2	1	2	20		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
EB	1	LTR	5	25	.203	1	185.5	F	185.5
	2								F
	3								
WB	1	R	125	326	.384	2	22.8	C	62.4
	2	L	20	26	.759	2	310.2	F	F
	3								
		1	257	649	.396	2	14.1	B	.
		4	0	944	0	<1	8.8	A	

CHAPTER 17 - TWSC - UNSIGNALIZED INTERSECTIONS WORKSHEET

Analysis Summary

General Information		Site Information	
Analyst	TL	Jurisdiction/Date	KULA, MAUI 12/23/200
Agency or Company	ATA	Major Street	KULA HWY
Analysis Period/Year	PM PEAK HOUR 2003	Minor Street	KKHS DRWY
Comment	EXISTING		

Input Data:

Lane Configuration	SB	NB	EB	WB
Lane 1 (curb)	TR	R	LTR	R
Lane 2	L	LT		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)	20	595	6	3	719	3	2	0	1	7		30
PHF	.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
Flow rate	22	661	7	3	799	3	2	0	1	8		33
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
EB	1	LTR	4	115	.035	<1	37.3	E	37.3
	2								E
	3								
WB	1	R	33	384	.086	<1	15.3	C	21.3
	2	L	8	95	.084	<1	46.5	E	C
	3								
		①	22	817	.027	<1	9.5	A	
		④	3	917	.004	<1	8.9	A	

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CHAPTER 17 - TWSC - UNSIGNALIZED INTERSECTIONS WORKSHEET

Analysis Summary

General Information		Site Information	
Analyst	TL	Jurisdiction/Date	KULA, MAUI 10/22/200
Agency or Company	ATA	Major Street	KULA HWY
Analysis Period/Year	AM PEAK HOUR 2003	Minor Street	AAPUEO PKWY
Comment	EXISTING		

Input Data:

Lane Configuration	SB	NB	EB	WB
Lane 1 (curb)	R	T	R	
Lane 2	T	L	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)		382	219	58	800		164		35			
PHF		.9	.9	.9	.9		.9		.9			
Proportion of heavy vehicles, HV		3	3	3	3		3		3			
Flow rate		424	243	64	889		182		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
EB	1	R	39	628	.062	<1	11.1	B	216.2
	2	L	182	135	1.35	12	260.1	F	F
	3								
WB	1								
	2								
	3								
		①							
		④	64	917	.07	<1	9.2	A	

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CHAPTER 17 • TWSC • UNSIGNALIZED INTERSECTIONS WORKSHEET

Analysis Summary

General Information		Site Information	
Analyst	TL	Jurisdiction/Date	KULA, MAUI 10/22/200
Agency or Company	ATA	Major Street	KULA HWY
Analysis Period/Year	PM PEAK HOUR 2003	Minor Street	AAPUEO PKWY
Comment	EXISTING		

Input Data

Lane Configuration	SB	NB	EB	WB
Lane 1 (curb)	R	T	R	
Lane 2	T	L	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)		538	57	9	507		217		31			
PHF		.9	.9	.9	.9		.9		.9			
Proportion of heavy vehicles, HV		3	3	3	3		3		3			
Flow rate		598	63	10	563		241		34			
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	34	501	.068	<1	12.7	B	143.9
	2	L	241	207	1.166	12	162.4	F	F
	3								
WB	1								
	2								
	3								
		1							
		4	10	923	.011	<1	8.9	A	

ATA AUSTIN, TSUTSUMI & ASSOCIATES, INC.
CIVIL ENGINEERS • SURVEYORS

APPENDIX C

LEVEL OF SERVICE CALCULATIONS

- Base Year 2005

CHAPTER 17 - TWSC - UNSIGNALIZED INTERSECTIONS WORKSHEET

Analysis Summary

General Information		Site Information	
Analyst	TL	Jurisdiction/Date	KULA, MAUI 12/23/200
Agency or Company	ATA	Major Street	HALEAKALA HWY
Analysis Period/Year	AM PEAK 2005	Minor Street	OLD HALEAKALA HWY
Comment	BASE YEAR 2005		

Input Data

Lane Configuration	EB	WB	NB	SB
Lane 1 (curb)	T	T	R	
Lane 2	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)		290			0		810		5			
PHF		.9			.9		.9		.9			
Proportion of heavy vehicles, HV		3			3		3		3			
Flow rate		322			0		900		6			
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	R	6	852	.007	<1	9.3	A	206.3
	2	L	900	644	1.398	40	207.6	F	F
	3								
SB	1								
	2								
	3								
		①							
		④							

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CHAPTER 17 - TWSC - UNSIGNALIZED INTERSECTIONS WORKSHEET

Analysis Summary

General Information		Site Information	
Analyst	TL	Jurisdiction/Date	KULA, MAUI 12/23/200
Agency or Company	ATA	Major Street	HALEAKALA HWY
Analysis Period/Year	PM PEAK 2005	Minor Street	OLD HALEAKALA HWY
Comment	BASE YEAR 2005		

Input Data

Lane Configuration	EB	WB	NB	SB
Lane 1 (curb)	T	T	R	
Lane 2	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)		790			0		305		5			
PHF		.9			.9		.9		.9			
Proportion of heavy vehicles, HV		3			3		3		3			
Flow rate		878			0		339		6			
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	R	6	563	.011	<1	11.5	B	149.5
	2	L	339	286	1.187	15	152	F	F
	3								
SB	1								
	2								
	3								
		①							
		④							

HICAP 2000™
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Institute for Astronomy                                                12/24/03
AM Peak Hour of Traffic                                                10:58:59
Base Year 2005 with traffic signal

SIGNAL2000/TEAPAC[Ver 1.11.00] - Capacity Analysis Summary

Intersection Averages for Int #   0 - Haleakala Highway/Hakani Road
    Degree of Saturation (v/c) 0.71  Vehicle Delay  37.3  Level of Service D+

      -------------------------
Sq 11 |  Phase 1   |  Phase 2  |
**/** -------------------------
      | * + +      |        ^  |
  .   | * + +      |     ****|
 /|\  |<* + +>     |    <****|
  |   |  v         |   ^  ++++|
  |   |       ^    |++++   v  |
North |    <+ + +> |++++>      |
  |   |     + + +  |++++       |
      |     + + +  |   v       |
      -------------------------
      | G/C=0.289 | G/C=0.600 |
      | G= 26.0"  | G= 54.0"  |
      | Y+R= 5.0" | Y+R= 5.0" |
      | OFF= 0.0% | OFF=34.4% |
      -------------------------
      C= 90 sec    G= 80.0 sec = 88.9%  Y=10.0 sec = 11.1%  Ped= 0.0 sec =  0.0%

-------------------------------------------------------------------------------
| Lane  |Width/|    g/C     | Service Rate| Adj |        |  HCM  | L | Queue |
| Group | Lanes| Reqd  Used | @C (vph) @E |Volume|  v/c  | Delay | S |Model 1|
-------------------------------------------------------------------------------
SB Approach                                                  41.6    D+
===============================================================================
|  RT   | 12/1 |0.338 |0.289 |  297 |  457 |  394 |0.862 |  49.2 |*D |  481 ft|
| TH+LT| 12/1 |0.228 |0.289 |  311 |  426 |  211 |0.495 |  27.5 | C+|  207 ft|
-------------------------------------------------------------------------------
NB Approach                                                  25.1    C+
===============================================================================
|  RT   | 12/1 |0.189 |0.289 |  297 |  457 |  106 |0.232 |  25.6 | C+|  102 ft|
| TH+LT| 12/1 |0.160 |0.289 |  381 |  509 |  117 |0.230 |  24.6 | C+|  105 ft|
-------------------------------------------------------------------------------
WB Approach                                                  46.1    D
===============================================================================
|RT+TH  | 12/1 |0.631 |0.600 | 1025 | 1110 | 1089 |0.981 |  46.9 |*D | 1324 ft|
|  LT   | 12/1 |0.134 |0.600 |  561 |  636 |   22 |0.035 |  10.3 | B+|   16 ft|
-------------------------------------------------------------------------------
EB Approach                                                   8.6    A
===============================================================================
|RT+TH  | 24/2 |0.166 |0.600 | 2097 | 2117 |  300 |0.142 |   7.9 | A |   82 ft|
|  LT   | 12/1 |0.225 |0.600 |   58 |   75 |   39 |0.470 |  14.2 | B+|   31 ft|
-------------------------------------------------------------------------------
```

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Institute for Astronomy                                                12/24/03
AM Peak Hour of Traffic                                                10:58:52
Base Year 2005 with traffic signal

SIGNAL2000/TEAPAC[Ver 1.11.00] - Summary of Parameter Values

  Intersection Parameters for Int #   0 - Haleakala Highway/Hakani Road
METROAREA              NONCBD
SIMULATION PERIOD          15
LEVELOFSERVICE          C    S
NODELOCATION            0    0
QUEUEMODELS     1   90  25  40

  Approach Parameters
APPLABELS              SB               WB               NB               EB
GRADES                0.0              0.0              0.0              0.0
PEDLEVELS               0                0                0                0
BIKEVOLUMES             0                0                0                0
PARKINGSIDES         NONE             NONE             NONE             NONE
PARKVOLUMES            20               20               20               20
BUSVOLUMES              0                0                0                0
RIGHTTURNONREDS         0                0                0                0
UPSTREAMVC           0.00             0.00             0.00             0.00

  Movement Parameters
MOVLABELS         RT   TH   LT    RT   TH   LT    RT   TH   LT    RT   TH   LT
VOLUMES          355  100   90    45  935   20    95   90   15     5  265   35
WIDTHS          12.0 12.0  0.0   0.0 12.0 12.0  12.0 12.0  0.0   0.0 24.0 12.0
LANES              1    1    0     0    1    1     1    1    0     0    2    1
GROUPTYPES      NORM NORM NORM  NORM NORM NORM  NORM NORM NORM  NORM NORM NORM
UTILIZATIONS    0.00 0.00 0.00  0.00 0.00 0.00  0.00 0.00 0.00  0.00 0.00 0.00
TRUCKPERCENTS    2.0  2.0  2.0   2.0  2.0  2.0   2.0  2.0  2.0   2.0  2.0  2.0
PEAKHOURFACTORS 0.90 0.90 0.90  0.90 0.90 0.90  0.90 0.90 0.90  0.90 0.90 0.90
ARRIVALTYPES       3    3    3     2    2    2     3    3    3     3    3    3
ACTUATIONS        NO  YES  YES    NO  YES  YES    NO  YES  YES    NO  YES  YES
REQCLEARANCES    5.0  5.0  5.0   5.0  5.0  5.0   5.0  5.0  5.0   5.0  5.0  5.0
MINIMUMS         5.0  5.0  5.0   5.0  5.0  5.0   5.0  5.0  5.0   5.0  5.0  5.0
STARTUPLOST      2.0  2.0  2.0   2.0  2.0  2.0   2.0  2.0  2.0   2.0  2.0  2.0
ENDGAIN          2.0  2.0  2.0   2.0  2.0  2.0   2.0  2.0  2.0   2.0  2.0  2.0
STORAGE            0    0    0     0    0    0     0    0    0     0    0    0
INITIALQUEUE       0    0    0     0    0    0     0    0    0     0    0    0
IDEALSATFLOWS   1900 1900 1900  1900 1900 1900  1900 1900 1900  1900 1900 1900
FACTORS         1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00
DELAYFACTORS    1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00
NSTOPFACTORS    1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00
SATURATIONFLOWS 1583 1473    0     0 1850 1059  1583 1762    0     0 3529  138

  Phasing Parameters
SEQUENCES         11     11
PERMISSIVES       NO     NO    NO     NO          LEADLAGS      NONE   NONE
OVERLAPS         YES    YES   YES    YES          OFFSET        0.00      1
CYCLES            90    180    10                 PEDTIME        0.0      0
GREENTIMES     26.00  54.00
YELLOWTIMES     5.00   5.00
CRITICALS          1      5
EXCESS             0
```

Institute for Astronomy
PM Peak Hour of Traffic
Base Year 2005 with traffic signal

12/24/03
11:07:00

SIGNAL2000/TEAPAC[Ver 1.11.00] - Capacity Analysis Summary

Intersection Averages for Int # 0 - Haleakala Highway/Makani Road
Degree of Saturation (v/c) 0.41 Vehicle Delay 9.4 Level of Service A

```
        ---------------------------
Sq 11 |  Phase 1  |  Phase 2  |
**/** ---------------------------
      | * + +     |        ^  |
      | * + +     |       ++++|
 /|\  |<* + +>    |      <++++|
  |   |   v       |    ^  ++++|
  |   |       ^   |****    v  |
North |    <+ + +>|++++>      |
  |   |     + + + |++++       |
      |     + + + |    v      |
        ---------------------------
      | G/C=0.183 | G/C=0.650 |
      | G=  11.0" | G=  39.0" |
      | Y+R= 5.0" | Y+R= 5.0" |
      | OFF= 0.0% | OFF=26.7% |
        ---------------------------
```

C= 60 sec G= 50.0 sec = 83.3% Y=10.0 sec = 16.7% Ped= 0.0 sec = 0.0%

Lane Group	Width/ Lanes	g/C Reqd	g/C Used	Service Rate @C (vph)	Service Rate @E	Adj Volume	v/c	HCM Delay	L S	Queue Model 1
SB Approach								22.9	C+	
RT	12/1	0.115	0.183	198	290	94	0.324	24.2	*C+	72 ft
TH+LT	12/1	0.076	0.183	256	327	83	0.254	21.4	C+	57 ft
NB Approach								21.4	C+	
RT	12/1	0.059	0.183	198	290	28	0.097	21.0	C+	21 ft
TH+LT	12/1	0.078	0.183	263	335	89	0.266	21.5	C+	62 ft
WB Approach								9.3	A	
RT+TH	12/1	0.404	0.650	1172	1203	684	0.569	9.4	A	391 ft
LT	12/1	0.000	0.650	430	472	33	0.070	5.9	A	16 ft
EB Approach								5.2	A	
RT+TH	24/2	0.218	0.650	2295	2295	683	0.298	4.6	A	126 ft
LT	12/1	0.425	0.650	303	336	178	0.530	7.2	*A	85 ft

Institute for Astronomy
PM Peak Hour of Traffic
Base Year 2005 with traffic signal

12/24/03
11:06:52

SIGNAL2000/TEAPAC[Ver 1.11.00] - Summary of Parameter Values

Intersection Parameters for Int # 0 - Haleakala Highway/Makani Road

METROAREA	NONCBD			
SIMULATION PERIOD	15			
LEVELOFSERVICE	C	S		
NODELOCATION	0	0		
QUEUEMODELS	1	90	25	40

Approach Parameters

APPLABELS	SB	WB	NB	EB
GRADES	0.0	0.0	0.0	0.0
PEDLEVELS	0	0	0	0
BIKEVOLUMES	0	0	0	0
PARKINGSIDES	NONE	NONE	NONE	NONE
PARKVOLUMES	20	20	20	20
BUSVOLUMES	0	0	0	0
RIGHTTURNONREDS	0	0	0	0
UPSTREAMVC	0.00	0.00	0.00	0.00

Movement Parameters

MOVLABELS	RT	TH	LT	RT	TH	LT	RT	TH	LT	RT	TH	LT
VOLUMES	85	65	10	25	590	30	25	75	5	10	605	160
WIDTHS	12.0	12.0	0.0	0.0	12.0	12.0	12.0	12.0	0.0	0.0	24.0	12.0
LANES	1	1	0	0	1	1	1	1	0	0	2	1
GROUPTYPES	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM
UTILIZATIONS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRUCKPERCENTS	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
PEAKHOURFACTORS	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
ARRIVALTYPES	3	3	3	2	2	2	3	3	3	3	3	3
ACTUATIONS	NO	YES	YES	NO	YES	YES	NO	YES	YES	NO	YES	YES
REQCLEARANCES	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
MINIMUMS	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
STARTUPLOST	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
ENDGAIN	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
STORAGE	0	0	0	0	0	0	0	0	0	0	0	0
INITIALQUEUE	0	0	0	0	0	0	0	0	0	0	0	0
IDEALSATFLOWS	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
FACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
DELAYFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
NSTOPFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
SATURATIONFLOWS	1583	1782	0	0	1851	677	1583	1825	0	0	3531	516

Phasing Parameters

SEQUENCES	11	11					
PERMISSIVES	NO	NO	NO	NO	LEADLAGS	NONE	NONE
OVERLAPS	YES	YES	YES	YES	OFFSET	0.00	1
CYCLES	60	180	10		PEDTIME	0.0	0
GREENTIMES	11.00	39.00					
YELLOWTIMES	5.00	5.00					
CRITICALS	1	12					
EXCESS	0						

Institute for Astronomy
AM Peak Hour of Traffic
Base Year 2005

12/24/03
11:09:04

SIGNAL2000/TEAPAC[Ver 1.11.00] - Capacity Analysis Summary

Intersection Averages for Int # 0 - Haleakala Highway/Makawao Aven
Degree of Saturation (v/c) 0.65 Vehicle Delay 38.9 Level of Service D+

```
------------------------------------------------------------
Sq 16 |  Phase 1   |  Phase 2   |  Phase 3   |  Phase 4   |
**/** ------------------------------------------------------
      | + + *      | +          | +          |         ^  |
  .   | + + *      | +          | +          |      ++++  |
 /|\  |<+ + *>     |<+          |<+          |     <****  |
  |   |   v        |    ^   ****|   ^        |            |
  |   |       ^    |++++    v   |****        |            |
North |    <+ + +> |          +>|++++>       |++++>       |
  |   |     + + +  |          + |++++        |++++        |
      |     + + +  |          + |   v        |   v        |
      ------------------------------------------------------
      | G/C=0.256  | G/C=0.056  | G/C=0.033  | G/C=0.433  |
      | G= 23.0"   | G=  5.0"   | G=  3.0"   | G= 39.0"   |
      | Y+R= 5.0"  | Y+R= 5.0"  | Y+R= 5.0"  | Y+R= 5.0"  |
      | OFF= 0.0%  | OFF=31.1%  | OFF=42.2%  | OFF=51.1%  |
      ------------------------------------------------------
      C= 90 sec   G= 70.0 sec = 77.8%  Y=20.0 sec = 22.2%  Ped= 0.0 sec =  0.0%
```

Lane Group	Width/ Lanes	g/C Reqd	g/C Used	Service Rate @C (vph)	Service Rate @E	Adj Volume	v/c	HCM Delay	L S	Queue Model 1
SB Approach								36.2	D+	
RT	12/1	0.293	0.456	623	721	306	0.424	18.4	B	244 ft
TH	12/1	0.234	0.256	335	476	289	0.607	31.8	C	299 ft
LT	12/1	0.311	0.256	217	323	294	0.902	59.2	*E+	386 ft
NB Approach								26.1	C+	
RT	12/1	0.128	0.367	451	581	11	0.019	18.2	B	10 ft
TH	12/1	0.155	0.256	335	476	111	0.233	26.8	C+	104 ft
LT	12/1	0.157	0.256	111	171	33	0.180	26.6	C+	32 ft
WB Approach								42.9	D+	
RT	12/1	0.295	0.433	546	686	289	0.421	22.5	C+	268 ft
TH	12/1	0.476	0.433	684	807	772	0.957	50.5	*D	949 ft
LT	12/1	0.120	0.056	1	80	6	0.061	40.5	*D+	7 ft
EB Approach								38.9	D+	
RT	12/1	0.132	0.522	712	827	17	0.021	13.2	B+	15 ft
TH	24/2	0.156	0.522	1729	1848	244	0.132	14.0	B+	102 ft
LT	12/1	0.214	0.144	74	243	228	0.891	67.4	*E+	310 ft

Institute for Astronomy
AM Peak Hour of Traffic
Base Year 2005

12/24/03
11:08:57

SIGNAL2000/TEAPAC[Ver 1.11.00] - Summary of Parameter Values

Intersection Parameters for Int # 0 - Haleakala Highway/Makawao Aven

METROAREA	NONCBD			
SIMULATION PERIOD	15			
LEVELOFSERVICE	C	S		
NODELOCATION	0	0		
QUEUEMODELS	1	90	25	40

Approach Parameters

APPLABELS	SB	WB	NB	EB
GRADES	0.0	0.0	0.0	0.0
PEDLEVELS	0	0	0	0
BIKEVOLUMES	0	0	0	0
PARKINGSIDES	NONE	NONE	NONE	NONE
PARKVOLUMES	20	20	20	20
BUSVOLUMES	0	0	0	0
RIGHTTURNONREDS	0	0	0	0
UPSTREAMVC	0.00	0.00	0.00	0.00

Movement Parameters

MOVLABELS	RT	TH	LT	RT	TH	LT	RT	TH	LT	RT	TH	LT
VOLUMES	275	260	265	260	695	5	10	100	30	15	220	205
WIDTHS	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	24.0	12.0
LANES	1	1	1	1	1	1	1	1	1	1	2	1
GROUPTYPES	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM
UTILIZATIONS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRUCKPERCENTS	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
PEAKHOURFACTORS	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
ARRIVALTYPES	3	3	3	2	2	2	3	3	3	2	2	2
ACTUATIONS	NO	YES	YES	NO	YES	YES	NO	YES	YES	NO	YES	YES
REQCLEARANCES	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
MINIMUMS	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
STARTUPLOST	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
ENDGAIN	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
STORAGE	0	0	0	0	0	0	0	0	0	0	0	0
INITIALQUEUE	0	0	0	0	0	0	0	0	0	0	0	0
IDEALSATFLOWS	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
FACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
DELAYFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
NSTOPFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
SATURATIONFLOWS	1583	1863	1277	1583	1863	1770	1583	1863	717	1583	3539	1770

Phasing Parameters

SEQUENCES	16	16					
PERMISSIVES	NO	NO	NO	NO	LEADLAGS	NONE	NONE
OVERLAPS	YES	YES	YES	YES	OFFSET	0.00	1
CYCLES	90	180	10		PEDTIME	0.0	0
GREENTIMES	23.00	5.00	3.00	39.00			
YELLOWTIMES	5.00	5.00	5.00	5.00			
CRITICALS	3	6	12	5			
EXCESS	0						

Institute for Astronomy
PM Peak Hour of Traffic
Base Year 2005

12/24/03
11:09:49

SIGNAL2000/TEAPAC[Ver 1.11.00] - Capacity Analysis Summary

Intersection Averages for Int # 0 - Haleakala Highway/Makawao Aven
Degree of Saturation (v/c) 0.62 Vehicle Delay 28.2 Level of Service C

```
---------------------------------------------------------
Sq 16 |  Phase 1   |  Phase 2   |  Phase 3   |  Phase 4  |
**/** ---------------------------------------------------
      | + + *      | +          | +          |        ^  |
  .   | + + *      | +          | +          |      ++++|
 /|\  |<+ + *>     |<+          |<+          |     <****|
  |   |   v        |    ^   ++++|   ^        |           |
  |   |       ^    |****    v   |++++        |           |
North |    <+ + +> |          +>|++++>       |++++>      |
  |   |      + + + |          + |++++        |++++       |
      |      + + + |          + |   v        |   v       |
      ---------------------------------------------------
      | G/C=0.317  | G/C=0.067  | G/C=0.017  | G/C=0.267 |
      | G=  19.0"  | G=   4.0"  | G=   1.0"  | G=  16.0" |
      | Y+R= 5.0"  | Y+R= 5.0"  | Y+R= 5.0"  | Y+R= 5.0" |
      | OFF= 0.0%  | OFF=40.0%  | OFF=55.0%  | OFF=65.0% |
      ---------------------------------------------------
      C= 60 sec   G= 40.0 sec = 66.7%  Y=20.0 sec = 33.3%  Ped= 0.0 sec =  0.0%
```

Lane Group	Width/ Lanes	g/C Reqd	g/C Used	Service Rate @C (vph)	Service Rate @E	Adj Volume	v/c	HCM Delay	L S	Queue Model 1
SB Approach								22.8	C+	
RT	12/1	0.171	0.567	866	897	178	0.198	6.8	A	77 ft
TH	12/1	0.221	0.317	525	590	339	0.575	18.5	B	227 ft
LT	12/1	0.351	0.317	132	171	150	0.857	51.2	*D	142 ft
NB Approach								21.7	C+	
RT	12/1	0.046	0.467	688	739	17	0.023	8.7	A	8 ft
TH	12/1	0.270	0.317	525	590	433	0.734	23.0	C+	316 ft
LT	12/1	0.000	0.317	200	250	50	0.200	15.4	B	30 ft
WB Approach								40.4	D+	
RT	12/1	0.206	0.267	332	422	233	0.552	24.9	C+	179 ft
TH	12/1	0.290	0.267	423	497	467	0.940	48.5	*D	444 ft
LT	12/1	0.018	0.067	70	106	11	0.093	26.6	C+	9 ft
EB Approach								25.7	C+	
RT	12/1	0.081	0.367	501	581	50	0.086	14.1	B+	34 ft
TH	24/2	0.134	0.367	1232	1298	383	0.295	15.1	B	129 ft
LT	12/1	0.181	0.167	225	295	250	0.847	44.3	*D+	228 ft

Institute for Astronomy
PM Peak Hour of Traffic
Base Year 2005

12/24/03
11:09:43

SIGNAL2000/TEAPAC[Ver 1.11.00] - Summary of Parameter Values

Intersection Parameters for Int # 0 - Haleakala Highway/Makawao Aven

METROAREA	NONCBD			
SIMULATION PERIOD	15			
LEVELOFSERVICE	C	S		
NODELOCATION	0	0		
QUEUEMODELS	1	90	25	40

Approach Parameters

APPLABELS	SB	WB	NB	EB
GRADES	0.0	0.0	0.0	0.0
PEDLEVELS	0	0	0	0
BIKEVOLUMES	0	0	0	0
PARKINGSIDES	NONE	NONE	NONE	NONE
PARKVOLUMES	20	20	20	20
BUSVOLUMES	0	0	0	0
RIGHTTURNONREDS	0	0	0	0
UPSTREAMVC	0.00	0.00	0.00	0.00

Movement Parameters

MOVLABELS	RT	TH	LT	RT	TH	LT	RT	TH	LT	RT	TH	LT
VOLUMES	160	305	135	210	420	10	15	390	45	45	345	225
WIDTHS	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	24.0	12.0
LANES	1	1	1	1	1	1	1	1	1	1	2	1
GROUPTYPES	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM
UTILIZATIONS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRUCKPERCENTS	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
PEAKHOURFACTORS	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
ARRIVALTYPES	3	3	3	2	2	2	3	3	3	2	2	2
ACTUATIONS	NO	YES	YES	NO	YES	YES	NO	YES	YES	NO	YES	YES
REQCLEARANCES	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
MINIMUMS	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
STARTUPLOST	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
ENDGAIN	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
STORAGE	0	0	0	0	0	0	0	0	0	0	0	0
INITIALQUEUE	0	0	0	0	0	0	0	0	0	0	0	0
IDEALSATFLOWS	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
FACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
DELAYFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
NSTOPFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
SATURATIONFLOWS	1583	1863	551	1583	1863	1770	1583	1863	791	1583	3539	1770

Phasing Parameters

SEQUENCES	16	16					
PERMISSIVES	NO	NO	NO	NO	LEADLAGS	NONE	NONE
OVERLAPS	YES	YES	YES	YES	OFFSET	0.00	1
CYCLES	60	180	10		PEDTIME	0.0	0
GREENTIMES	19.00	4.00	1.00	16.00			
YELLOWTIMES	5.00	5.00	5.00	5.00			
CRITICALS	3	12	0	5			
EXCESS	0						

Institute for Astronomy
AM Peak Hour of Traffic
Base Year 2005

12/24/03
11:11:20

SIGNAL2000/TEAPAC[Ver 1.11.00] - Capacity Analysis Summary

Intersection Averages for Int # 0 - Kula Highway/Haleakala Highway
Degree of Saturation (v/c) 0.79 Vehicle Delay 39.6 Level of Service D+

```
       ---------------------------------------------
Sq 61 |  Phase 1  |  Phase 2  |  Phase 3  |  Phase 4  |
**/** ---------------------------------------------
      |     *     |           | + +       |           |
  .   |     *     |           | + +       |           |
 /|\  |     *>    |           |<+ +       |     <****|
  |   |           |           |    v      |  ^   ****|
  |   |           |       ^   |        ^  |++++   v  |
North |    <+     |    <* +   |        *  |++++>     |
  |   |     +     |     * +   |        *  |          |
      |     +     |     * +   |        *  |          |
       ---------------------------------------------
      | G/C=0.078 | G/C=0.067 | G/C=0.378 | G/C=0.256 |
      | G=   7.0" | G=   6.0" | G=  34.0" | G=  23.0" |
      | Y+R= 5.0" | Y+R= 5.0" | Y+R= 5.0" | Y+R= 5.0" |
      | OFF= 0.0% | OFF=13.3% | OFF=25.6% | OFF=68.9% |
       ---------------------------------------------
       C= 90 sec   G= 70.0 sec = 77.8%  Y=20.0 sec = 22.2%  Ped= 0.0 sec =  0.0%
```

Lane Group	Width/ Lanes	g/C Reqd	g/C Used	Service Rate @C (vph)	Service Rate @E	Adj Volume	v/c	HCM Delay	L S	Queue Model 1
SB Approach								32.7	C	
RT	12/1	0.123	0.378	442	598	6	0.010	19.6	B	6 ft
TH	12/1	0.334	0.378	569	704	478	0.679	28.9	C	489 ft
LT	12/1	0.152	0.078	1	119	94	0.681	53.3	*D	121 ft
NB Approach								44.5	D+	
TH	12/1	0.524	0.500	823	931	872	0.937	42.6	*D+	1017 ft
LT	12/1	0.251	0.200	203	349	294	0.831	50.1	*D	364 ft
WB Approach								40.3	D+	
TH+LT	12/1	0.276	0.256	216	322	244	0.751	40.3	*D+	281 ft
EB Approach								27.9	C	
TH+LT	12/1	0.176	0.256	330	470	167	0.355	27.9	C	160 ft

Institute for Astronomy
AM Peak Hour of Traffic
Base Year 2005

12/24/03
11:11:11

SIGNAL2000/TEAPAC[Ver 1.11.00] - Summary of Parameter Values

Intersection Parameters for Int # 0 - Kula Highway/Haleakala Highway

METROAREA	NONCBD			
SIMULATION PERIOD	15			
LEVELOFSERVICE	C	S		
NODELOCATION	0	0		
QUEUEMODELS	1	90	25	40

Approach Parameters

APPLABELS	SB	WB	NB	EB
GRADES	0.0	0.0	0.0	0.0
PEDLEVELS	0	0	0	0
BIKEVOLUMES	0	0	0	0
PARKINGSIDES	NONE	NONE	NONE	NONE
PARKVOLUMES	20	20	20	20
BUSVOLUMES	0	0	0	0
RIGHTTURNONREDS	0	0	0	0
UPSTREAMVC	0.00	0.00	0.00	0.00

Movement Parameters

MOVLABELS	RT	TH	LT	RT	TH	LT	RT	TH	LT	RT	TH	LT
VOLUMES	5	430	85	165	100	120	130	785	265	445	145	5
WIDTHS	12.0	12.0	12.0	12.0	12.0	0.0	12.0	12.0	12.0	12.0	12.0	0.0
LANES	1	1	1	1	1	0	1	1	1	1	1	0
GROUPTYPES	NORM	NORM	NORM	FFLW	NORM	NORM	FFLW	NORM	NORM	FFLW	NORM	NORM
UTILIZATIONS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRUCKPERCENTS	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
PEAKHOURFACTORS	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
ARRIVALTYPES	2	2	2	3	3	3	2	2	2	3	3	3
ACTUATIONS	NO	YES	YES	NO	YES	YES	NO	YES	YES	NO	YES	YES
REQCLEARANCES	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
MINIMUMS	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
STARTUPLOST	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
ENDGAIN	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
STORAGE	0	0	0	0	0	0	0	0	0	0	0	0
INITIALQUEUE	0	0	0	0	0	0	0	0	0	0	0	0
IDEALSATFLOWS	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
FACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
DELAYFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
NSTOPFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
SATURATIONFLOWS	1583	1863	1770	0	1272	0	0	1863	1770	0	1840	0

Phasing Parameters

SEQUENCES	61	61					
PERMISSIVES	NO	NO	NO	NO	LEADLAGS	NONE	NONE
OVERLAPS	YES	YES	YES	YES	OFFSET	0.00	1
CYCLES	90	180	10		PEDTIME	0.0	0
GREENTIMES	7.00	6.00	34.00	23.00			
YELLOWTIMES	5.00	5.00	5.00	5.00			
CRITICALS	3	9	8	5			
EXCESS	0						

Institute for Astronomy
PM Peak Hour of Traffic
Base Year 2005

12/24/03
11:12:12

SIGNAL2000/TEAPAC[Ver 1.11.00] - Capacity Analysis Summary

Intersection Averages for Int # 0 - Kula Highway/Haleakala Highway
Degree of Saturation (v/c) 0.67 Vehicle Delay 22.0 Level of Service C+

```
        --------------------------------------------------
Sq 61  | Phase 1  | Phase 2  | Phase 3  | Phase 4  |
**/**  --------------------------------------------------
       |    *     |          | + *      |          |
       |    *     |          | + *      |     <****|
 /|\   |    *>    |          |<+ *      |  ^   ****|
  |    |          |      ^   |   v   ^  |++++   v  |
  |    |          |          |       +  |++++>     |
North  |   <+     |   <* +   |       +  |          |
  |    |    +     |    * +   |       +  |          |
       |    +     |    * +   |          |          |
       --------------------------------------------------
       | G/C=0.100 | G/C=0.050 | G/C=0.367 | G/C=0.150 |
       | G=   6.0" | G=   3.0" | G=  22.0" | G=   9.0" |
       | Y+R= 5.0" | Y+R= 5.0" | Y+R= 5.0" | Y+R= 5.0" |
       | OFF= 0.0% | OFF=18.3% | OFF=31.7% | OFF=76.7% |
       --------------------------------------------------
       C= 60 sec   G= 40.0 sec = 66.7%  Y=20.0 sec = 33.3%  Ped= 0.0 sec =  0.0%
```

Lane Group	Width/ Lanes	g/C Reqd	g/C Used	Service Rate @C (vph)	Service Rate @E	Adj Volume	v/c	HCM Delay	L S	Queue Model 1
SB Approach								22.9	C+	
RT	12/1	0.027	0.367	501	581	6	0.010	13.4	B+	4 ft
TH	12/1	0.311	0.367	616	683	506	0.741	22.7	*C+	375 ft
LT	12/1	0.056	0.100	118	169	56	0.316	26.1	*C+	44 ft
NB Approach								20.8	C+	
TH	12/1	0.373	0.500	879	931	628	0.675	16.0	B	417 ft
LT	12/1	0.220	0.233	340	413	317	0.768	30.5	*C	259 ft
WB Approach								26.3	C+	
TH+LT	12/1	0.121	0.150	163	221	122	0.542	26.3	*C+	95 ft
EB Approach								23.2	C+	
TH+LT	12/1	0.071	0.150	202	271	78	0.288	23.2	C+	56 ft

Institute for Astronomy
PM Peak Hour of Traffic
Base Year 2005

12/24/03
11:12:07

SIGNAL2000/TEAPAC[Ver 1.11.00] - Summary of Parameter Values

Intersection Parameters for Int # 0 - Kula Highway/Haleakala Highway

METROAREA	NONCBD	
SIMULATION PERIOD	15	
LEVELOFSERVICE	C	S
NODELOCATION	0	0
QUEUEMODELS	1 90	25 40

Approach Parameters

APPLABELS	SB	WB	NB	EB
GRADES	0.0	0.0	0.0	0.0
PEDLEVELS	0	0	0	0
BIKEVOLUMES	0	0	0	0
PARKINGSIDES	NONE	NONE	NONE	NONE
PARKVOLUMES	20	20	20	20
BUSVOLUMES	0	0	0	0
RIGHTTURNONREDS	0	0	0	0
UPSTREAMVC	0.00	0.00	0.00	0.00

Movement Parameters

MOVLABELS	RT	TH	LT	RT	TH	LT	RT	TH	LT	RT	TH	LT
VOLUMES	5	455	50	80	55	55	40	565	285	270	65	5
WIDTHS	12.0	12.0	12.0	12.0	12.0	0.0	12.0	12.0	12.0	12.0	12.0	0.0
LANES	1	1	1	1	1	0	1	1	1	1	1	0
GROUPTYPES	NORM	NORM	NORM	FFLW	NORM	NORM	FFLW	NORM	NORM	FFLW	NORM	NORM
UTILIZATIONS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRUCKPERCENTS	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
PEAKHOURFACTORS	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
ARRIVALTYPES	2	2	2	3	3	3	2	2	2	3	3	3
ACTUATIONS	NO	YES	YES	NO	YES	YES	NO	YES	YES	NO	YES	YES
REQCLEARANCES	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
MINIMUMS	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
STARTUPLOST	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
ENDGAIN	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
STORAGE	0	0	0	0	0	0	0	0	0	0	0	0
INITIALQUEUE	0	0	0	0	0	0	0	0	0	0	0	0
IDEALSATFLOWS	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
FACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
DELAYFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
NSTOPFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
SATURATIONFLOWS	1583	1863	1770	0	1497	0	0	1863	1770	0	1805	0

Phasing Parameters

SEQUENCES	61	61			LEADLAGS	NONE	NONE
PERMISSIVES	NO	NO	NO	NO	OFFSET	0.00	1
OVERLAPS	YES	YES	YES	YES	PEDTIME	0.0	0
CYCLES	60	180	10				
GREENTIMES	6.00	3.00	22.00	9.00			
YELLOWTIMES	5.00	5.00	5.00	5.00			
CRITICALS	3	9	2	5			
EXCESS	0						

Institute for Astronomy
AM Peak Hour of Traffic
Base Year 2005

12/23/03
11:11:00

SIGNAL2000/TEAPAC[Ver 1.11.00] - Capacity Analysis Summary

Intersection Averages for Int # 0 - Old Haleakala Hwy/Pukalani St
Degree of Saturation (v/c) 0.53 Vehicle Delay 14.5 Level of Service B+

```
      ---------------------------------------
Sq  0 |  Phase 1  |  Phase 2  |  Phase 3  |
**/** ---------------------------------------
      |           |           |           |
 /|\  |           |           |           |
  |   |           |      <++++|      <++++|
  |   |           |       ****|       ++++|
  |   |           |       v   |       v   |
North |     <+  *>|           |           |
  |   |           |         +>|++++>      |
      |++++ +  *  |         + |++++       |
      |   v +  *  |         + |   v       |
      ---------------------------------------
      | G/C=0.467 | G/C=0.083 | G/C=0.283 |
      | G= 28.0"  | G=  5.0"  | G= 17.0"  |
      | Y+R= 5.0" | Y+R= 5.0" | Y+R= 0.0" |
      | OFF= 0.0% | OFF=55.0% | OFF=71.7% |
      ---------------------------------------
C= 60 sec   G= 50.0 sec = 83.3%  Y=10.0 sec = 16.7%  Ped= 0.0 sec =  0.0%
```

Lane Group	Width/ Lanes	g/C Reqd	g/C Used	Service Rate @C (vph)	Service Rate @E	Adj Volume	v/c	HCM Delay	L S	Queue Model 1
NB Approach								13.8	B+	
RT	12/1	0.226	0.633	985	1003	267	0.266	5.5	*A	105 ft
LT	12/1	0.386	0.467	783	826	628	0.760	17.4	B	419 ft
WB Approach								19.4	B	
TH	12/1	0.170	0.367	625	683	244	0.357	14.2	B+	141 ft
LT	12/1	0.052	0.083	397	452	339	0.750	23.2	*C+	253 ft
EB Approach								7.9	A	
RT	12/1	0.212	0.750	1188	1188	244	0.205	2.6	A	69 ft
TH	12/1	0.084	0.200	301	373	100	0.268	20.7	C+	68 ft

Institute for Astronomy
AM Peak Hour of Traffic
Base Year 2005

12/23/03
11:11:12

SIGNAL2000/TEAPAC[Ver 1.11.00] - Summary of Parameter Values

Intersection Parameters for Int # 0 - Old Haleakala Hwy/Pukalani St

METROAREA	NONCBD			
SIMULATION PERIOD	15			
LEVELOFSERVICE	C	S		
NODELOCATION	0	0		
QUEUEMODELS	1	90	25	40

Approach Parameters

APPLABELS	SB	WB	NB	EB
GRADES	0.0	0.0	0.0	0.0
PEDLEVELS	0	0	0	0
BIKEVOLUMES	0	0	0	0
PARKINGSIDES	NONE	NONE	NONE	NONE
PARKVOLUMES	20	20	20	20
BUSVOLUMES	0	0	0	0
RIGHTTURNONREDS	0	0	0	0
UPSTREAMVC	0.00	0.00	0.00	0.00

Movement Parameters

MOVLABELS	RT	TH	LT	RT	TH	LT	RT	TH	LT	RT	TH	LT
VOLUMES	0	0	0	0	220	305	240	0	565	220	90	0
WIDTHS	0.0	0.0	0.0	0.0	12.0	12.0	12.0	0.0	12.0	12.0	12.0	0.0
LANES	0	0	0	0	1	1	1	0	1	1	1	0
GROUPTYPES	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM
UTILIZATIONS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRUCKPERCENTS	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
PEAKHOURFACTORS	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
ARRIVALTYPES	3	3	3	3	3	3	3	3	3	3	3	3
ACTUATIONS	NO	YES	YES	NO	YES	YES	NO	YES	YES	NO	YES	YES
REQCLEARANCES	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
MINIMUMS	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
STARTUPLOST	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
ENDGAIN	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
STORAGE	0	0	0	0	0	0	0	0	0	0	0	0
INITIALQUEUE	0	0	0	0	0	0	0	0	0	0	0	0
IDEALSATFLOWS	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
FACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
DELAYFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
NSTOPFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
SATURATIONFLOWS	0	0	0	0	1863	1770	1583	0	1770	1583	1863	0

Institute for Astronomy
AM Peak Hour of Traffic
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12/23/03
11:11:12

SIGNAL2000/TEAPAC[Ver 1.11.00] - Summary of Parameter Values

```
   Phasing Parameters
SEQUENCES              0     0
PERMISSIVES          YES   YES   YES   YES        LEADLAGS      NONE   NONE
OVERLAPS             YES   YES   YES   YES        OFFSET        0.00      1
CYCLES                60   120    10              PEDTIME        0.0      0
GREENTIMES         28.00  5.00 17.00
YELLOWTIMES         5.00  5.00  0.00
CRITICALS              7     6     2
EXCESS                 0
PHASEMOVEMENTS         1     7     9    10     0     0     0
PHASEMOVEMENTS         2     6     7     5     0     0     0
PHASEMOVEMENTS         3     5    10    11    -6     0     0
PHASEMOVEMENTS         4     0     0     0     0     0     0
PHASEMOVEMENTS         5     0     0     0     0     0     0
PHASEMOVEMENTS         6     0     0     0     0     0     0
```

Institute for Astronomy
PM Peak Hour of Traffic
Base Year 2005

12/23/03
11:12:15

SIGNAL2000/TEAPAC[Ver 1.11.00] - Capacity Analysis Summary

```
Intersection Averages for Int #   0 - Old Haleakala Hwy/Pukalani St
     Degree of Saturation (v/c) 0.49  Vehicle Delay  11.8  Level of Service B+

        ------------------------------------------
Sq  0 |  Phase 1  |  Phase 2  |  Phase 3  |
**/** ------------------------------------------
      |           |           |           |
      |           |           |           |
 /|\  |           |     <++++|     <++++|
  |   |           |      ****|      ++++|
  |   |           |       v  |       v  |
North |     <+   +>|        +>|++++>     |
  |   |++++ +    * |        + |++++      |
      |  v +     * |        + |  v       |
        ------------------------------------------
      | G/C=0.300 | G/C=0.083 | G/C=0.450 |
      | G=  18.0" | G=   5.0" | G=  27.0" |
      | Y+R= 5.0" | Y+R= 5.0" | Y+R= 0.0" |
      | OFF= 0.0% | OFF=38.3% | OFF=55.0% |
        ------------------------------------------
        C= 60 sec   G= 50.0 sec = 83.3%  Y=10.0 sec = 16.7%  Ped= 0.0 sec =  0.0%
```

Lane Group	Width/ Lanes	g/C Reqd	g/C Used	Service Rate @C (vph)	Service Rate @E	Adj Volume	v/c	HCM Delay	L S	Queue Model 1
NB Approach								16.3	B	
RT	12/1	0.297	0.467	688	739	389	0.526	14.0	*B+	226 ft
LT	12/1	0.213	0.300	465	531	306	0.576	19.3	B	209 ft
WB Approach								12.4	B+	
TH	12/1	0.116	0.533	963	993	150	0.151	7.2	A	61 ft
LT	12/1	0.018	0.083	528	568	400	0.704	14.4	*B+	252 ft
EB Approach								6.9	A	
RT	12/1	0.367	0.750	1188	1188	511	0.430	3.9	A	169 ft
TH	12/1	0.154	0.367	625	683	217	0.318	13.9	B+	123 ft

Institute for Astronomy
PM Peak Hour of Traffic
Base Year 2005

12/23/03
11:12:22

SIGNAL2000/TEAPAC[Ver 1.11.00] - Summary of Parameter Values

Intersection Parameters for Int # 0 - Old Haleakala Hwy/Pukalani St

METROAREA	NONCBD			
SIMULATION PERIOD	15			
LEVELOFSERVICE	C	S		
NODELOCATION	0	0		
QUEUEMODELS	1	90	25	40

Approach Parameters

APPLABELS	SB	WB	NB	EB
GRADES	0.0	0.0	0.0	0.0
PEDLEVELS	0	0	0	0
BIKEVOLUMES	0	0	0	0
PARKINGSIDES	NONE	NONE	NONE	NONE
PARKVOLUMES	20	20	20	20
BUSVOLUMES	0	0	0	0
RIGHTTURNONREDS	0	0	0	0
UPSTREAMVC	0.00	0.00	0.00	0.00

Movement Parameters

MOVLABELS	RT	TH	LT	RT	TH	LT	RT	TH	LT	RT	TH	LT
VOLUMES	0	0	0	0	135	360	350	0	275	460	195	0
WIDTHS	0.0	0.0	0.0	0.0	12.0	12.0	12.0	0.0	12.0	12.0	12.0	0.0
LANES	0	0	0	0	1	1	1	0	1	1	1	0
GROUPTYPES	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM
UTILIZATIONS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRUCKPERCENTS	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
PEAKHOURFACTORS	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
ARRIVALTYPES	3	3	3	3	3	3	3	3	3	3	3	3
ACTUATIONS	NO	YES	YES	NO	YES	YES	NO	YES	YES	NO	YES	YES
REQCLEARANCES	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
MINIMUMS	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
STARTUPLOST	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
ENDGAIN	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
STORAGE	0	0	0	0	0	0	0	0	0	0	0	0
INITIALQUEUE	0	0	0	0	0	0	0	0	0	0	0	0
IDEALSATFLOWS	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
FACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
DELAYFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
NSTOPFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
SATURATIONFLOWS	0	0	0	0	1863	1770	1583	0	1770	1583	1863	0

Institute for Astronomy
PM Peak Hour of Traffic
Base Year 2005

12/23/03
11:12:22

SIGNAL2000/TEAPAC[Ver 1.11.00] - Summary of Parameter Values

Phasing Parameters

SEQUENCES	0	0					
PERMISSIVES	YES	YES	YES	YES			
OVERLAPS	YES	YES	YES	YES			
CYCLES	60	120	10				
GREENTIMES	18.00	5.00	27.00				
YELLOWTIMES	5.00	5.00	0.00				
CRITICALS	7	6	2				
EXCESS	0						
PHASEMOVEMENTS	1	7	9	10	0	0	0
PHASEMOVEMENTS	2	6	7	5	0	0	0
PHASEMOVEMENTS	3	5	10	11	-6	0	0
PHASEMOVEMENTS	4	0	0	0	0	0	0
PHASEMOVEMENTS	5	0	0	0	0	0	0
PHASEMOVEMENTS	6	0	0	0	0	0	0

LEADLAGS	NONE	NONE
OFFSET	0.00	1
PEDTIME	0.0	0

Institute for Astronomy
AM Peak Hour of Traffic
Base Year 2005

12/23/03
11:08:42

SIGNAL2000/TEAPAC[Ver 1.11.00] - Capacity Analysis Summary

Intersection Averages for Int # 0 - Old Haleakala Highway/Makawao
Degree of Saturation (v/c) 0.53 Vehicle Delay 16.2 Level of Service B

```
        ---------------------------------------
Sq  0 | Phase 1    | Phase 2   | Phase 3     |
**/** ---------------------------------------
      | +  *  *    |           |         ^   |
      | +  *  *    |           |      ****   |
 /|\  |<+  *  *>   |           |     <****   |
  |   |    v       |     ^     |    ^  ****  |
  |   |        ^   |++++       |++++   v     |
North |    <+  +  +>|++++>      |++++>        |
  |   |     +  +  + |++++       |++++         |
      |     +  +  + |    v      |   v         |
      ----------------------------------------
      | G/C=0.300 | G/C=0.050 | G/C=0.400 |
      | G=  18.0" | G=   3.0" | G=  24.0" |
      | Y+R= 5.0" | Y+R= 5.0" | Y+R= 5.0" |
      | OFF= 0.0% | OFF=38.3% | OFF=51.7% |
      ----------------------------------------
 C= 60 sec   G= 45.0 sec = 75.0%  Y=15.0 sec = 25.0%  Ped= 0.0 sec =  0.0%
```

Lane Group	Width/ Lanes	g/C Reqd	g/C Used	Service Rate @C (vph)	Service Rate @E	Adj Volume	v/c	HCM Delay	L S	Queue Model 1
SB Approach								19.7	B	
RT	12/1	0.209	0.300	395	475	239	0.503	21.1	C+	166 ft
TH+LT	12/1	0.125	0.300	319	379	105	0.277	16.4	*B	65 ft
NB Approach								21.5	C+	
RT+TH+LT	12/1	0.238	0.300	426	491	322	0.656	21.5	C+	230 ft
WB Approach								18.0	B	
RT+TH+LT	12/1	0.315	0.400	599	653	450	0.689	18.0	*B	302 ft
EB Approach								8.5	A	
RT+TH	12/1	0.266	0.533	956	986	422	0.428	8.8	A	202 ft
LT	12/1	0.060	0.533	913	944	61	0.065	6.8	A	24 ft

Institute for Astronomy
AM Peak Hour of Traffic
Base Year 2005

12/23/03
11:08:57

SIGNAL2000/TEAPAC[Ver 1.11.00] - Summary of Parameter Values

Intersection Parameters for Int # 0 - Old Haleakala Highway/Makawao

METROAREA	NONCBD			
SIMULATION PERIOD	15			
LEVELOFSERVICE	C	S		
NODELOCATION	0	0		
QUEUEMODELS	1	90	25	40

Approach Parameters

APPLABELS	SB	WB	NB	EB
GRADES	0.0	0.0	0.0	0.0
PEDLEVELS	0	0	0	0
BIKEVOLUMES	0	0	0	0
PARKINGSIDES	NONE	NONE	NONE	NONE
PARKVOLUMES	20	20	20	20
BUSVOLUMES	0	0	0	0
RIGHTTURNONREDS	0	0	0	0
UPSTREAMVC	0.00	0.00	0.00	0.00

Movement Parameters

MOVLABELS	RT	TH	LT	RT	TH	LT	RT	TH	LT	RT	TH	LT
VOLUMES	215	40	55	65	285	55	185	75	30	20	360	55
WIDTHS	12.0	12.0	0.0	0.0	12.0	0.0	0.0	12.0	0.0	0.0	12.0	12.0
LANES	1	1	0	0	1	0	0	1	0	0	1	1
GROUPTYPES	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM
UTILIZATIONS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRUCKPERCENTS	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
PEAKHOURFACTORS	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
ARRIVALTYPES	3	3	3	3	3	3	3	3	3	3	3	3
ACTUATIONS	NO	YES	YES	NO	YES	YES	NO	YES	YES	NO	YES	YES
REQCLEARANCES	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
MINIMUMS	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
STARTUPLOST	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
ENDGAIN	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
STORAGE	0	0	0	0	0	0	0	0	0	0	0	0
INITIALQUEUE	0	0	0	0	0	0	0	0	0	0	0	0
IDEALSATFLOWS	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
FACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
DELAYFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
NSTOPFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
SATURATIONFLOWS	1583	1264	0	0	1632	0	0	1638	0	0	1848	1770

```
Institute for Astronomy                                        12/23/03
AM Peak Hour of Traffic                                        11:08:57
Base Year 2005

SIGNAL2000/TEAPAC[Ver 1.11.00] - Summary of Parameter Values

   Phasing Parameters
SEQUENCES            0     0
PERMISSIVES         NO    NO    NO    NO        LEADLAGS      NONE   NONE
OVERLAPS           YES   YES   YES   YES        OFFSET        0.00      1
CYCLES              60   120    10              PEDTIME        0.0      0
GREENTIMES       18.00  3.00 24.00
YELLOWTIMES       5.00  5.00  5.00
CRITICALS            2     6     5
EXCESS               0
PHASEMOVEMENTS       1     1     2     3     7     8     9
PHASEMOVEMENTS       2    10    11    12     0     0     0
PHASEMOVEMENTS       3     4     5     6    10    11    12
PHASEMOVEMENTS       4     0     0     0     0     0     0
PHASEMOVEMENTS       5     0     0     0     0     0     0
PHASEMOVEMENTS       6     0     0     0     0     0     0
```

```
Institute for Astronomy                                        12/23/03
PM Peak Hour of Traffic                                        11:09:57
Base Year 2005

SIGNAL2000/TEAPAC[Ver 1.11.00] - Capacity Analysis Summary

Intersection Averages for Int #    0 - Old Haleakala Highway/Makawao
     Degree of Saturation (v/c) 0.45  Vehicle Delay  14.2  Level of Service B+

Sq  0 |  Phase 1  |  Phase 2  |  Phase 3  |
**/** -------------------------------------
      | + * *     |           |        ^  |
  .   | + * *     |           |       ****|
 /|\  |<+ * *>    |       ^   |      <****|
  |   |  v        |           |    ^  ****|
  |   |       ^   |++++       |++++   v   |
North |    <+ + +>|++++>      |++++>      |
  |   |     + + + |++++       |++++       |
      |     + + + |    v      |    v      |

      | G/C=0.300 | G/C=0.050 | G/C=0.400 |
      | G= 18.0"  | G=  3.0"  | G= 24.0"  |
      | Y+R= 5.0" | Y+R= 5.0" | Y+R= 5.0" |
      | OFF= 0.0% | OFF=38.3% | OFF=51.7% |
      -------------------------------------
      C= 60 sec   G= 45.0 sec = 75.0%  Y=15.0 sec = 25.0%  Ped= 0.0 sec = 0.0%

----------------------------------------------------------------------------
| Lane   |Width/|    g/C      | Service Rate| Adj  |       | HCM  | L | Queue |
| Group  | Lanes| Reqd   Used | @C (vph) @E |Volume|  v/c  | Delay| S |Model 1|
----------------------------------------------------------------------------
SB Approach                                                  22.1   C+
============================================================================
|  RT    | 12/1 |0.245 |0.300 |  395 |  475 |  300 |0.632 |  24.4 | C+| 219 ft|
|  TH+LT | 12/1 |0.120 |0.300 |  389 |  452 |  122 |0.270 |  16.3 |*B |  75 ft|
----------------------------------------------------------------------------
NB Approach                                                  16.1   B
============================================================================
|RT+TH+LT| 12/1 |0.108 |0.300 |  441 |  506 |  122 |0.241 |  16.1 | B |  74 ft|
----------------------------------------------------------------------------
WB Approach                                                  15.5   B
============================================================================
|RT+TH+LT| 12/1 |0.277 |0.400 |  622 |  676 |  400 |0.592 |  15.5 |*B | 251 ft|
----------------------------------------------------------------------------
EB Approach                                                   8.3   A
============================================================================
|RT+TH   | 12/1 |0.224 |0.533 |  949 |  979 |  339 |0.346 |   8.2 | A | 154 ft|
|  LT    | 12/1 |0.234 |0.533 |  913 |  944 |  344 |0.364 |   8.3 | A | 159 ft|
----------------------------------------------------------------------------
```

Institute for Astronomy
PM Peak Hour of Traffic
Base Year 2005

12/23/03
11:10:07

SIGNAL2000/TEAPAC[Ver 1.11.00] - Summary of Parameter Values

Intersection Parameters for Int # 0 - Old Haleakala Highway/Makawao

METROAREA	NONCBD			
SIMULATION PERIOD	15			
LEVELOFSERVICE	C	S		
NODELOCATION	0	0		
QUEUEMODELS	1	90	25	40

Approach Parameters

APPLABELS	SB	WB	NB	EB
GRADES	0.0	0.0	0.0	0.0
PEDLEVELS	0	0	0	0
BIKEVOLUMES	0	0	0	0
PARKINGSIDES	NONE	NONE	NONE	NONE
PARKVOLUMES	20	20	20	20
BUSVOLUMES	0	0	0	0
RIGHTTURNONREDS	0	0	0	0
UPSTREAMVC	0.00	0.00	0.00	0.00

Movement Parameters

MOVLABELS	RT	TH	LT	RT	TH	LT	RT	TH	LT	RT	TH	LT
VOLUMES	270	55	55	70	250	40	30	60	20	30	275	310
WIDTHS	12.0	12.0	0.0	0.0	12.0	0.0	0.0	12.0	0.0	0.0	12.0	12.0
LANES	1	1	0	0	1	0	0	1	0	0	1	1
GROUPTYPES	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM
UTILIZATIONS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRUCKPERCENTS	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
PEAKHOURFACTORS	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
ARRIVALTYPES	3	3	3	3	3	3	3	3	3	3	3	3
ACTUATIONS	NO	YES	YES	NO	YES	YES	NO	YES	YES	NO	YES	YES
REQCLEARANCES	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
MINIMUMS	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
STARTUPLOST	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
ENDGAIN	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
STORAGE	0	0	0	0	0	0	0	0	0	0	0	0
INITIALQUEUE	0	0	0	0	0	0	0	0	0	0	0	0
IDEALSATFLOWS	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
FACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
DELAYFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
NSTOPFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
SATURATIONFLOWS	1583	1506	0	0	1690	0	0	1688	0	0	1836	1770

Institute for Astronomy
PM Peak Hour of Traffic
Base Year 2005

12/23/03
11:10:07

SIGNAL2000/TEAPAC[Ver 1.11.00] - Summary of Parameter Values

Phasing Parameters

SEQUENCES	0	0					
PERMISSIVES	NO	NO	NO	NO			
OVERLAPS	YES	YES	YES	YES			
CYCLES	60	120	10				
GREENTIMES	18.00	3.00	24.00				
YELLOWTIMES	5.00	5.00	5.00				
CRITICALS	2	6	5				
EXCESS	0						
PHASEMOVEMENTS	1	1	2	3	7	8	9
PHASEMOVEMENTS	2	10	11	12	0	0	0
PHASEMOVEMENTS	3	4	5	6	10	11	12
PHASEMOVEMENTS	4	0	0	0	0	0	0
PHASEMOVEMENTS	5	0	0	0	0	0	0
PHASEMOVEMENTS	6	0	0	0	0	0	0

LEADLAGS	NONE	NONE
OFFSET	0.00	1
PEDTIME	0.0	0

CHAPTER 17 - TWSC - UNSIGNALIZED INTERSECTIONS WORKSHEET

Analysis Summary

General Information

Analyst	TL	Jurisdiction/Date	KULA, MAUI 12/23/200
Agency or Company	ATA	Major Street	KULA HWY
Analysis Period/Year	AM PEAK HOUR 2005	Minor Street	KKHS DRWY
Comment	BASE YEAR 2005		

Input Data

Lane Configuration	SB	NB	EB	WB
Lane 1 (curb)	TR	R	LTR	R
Lane 2	L	LT		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)	230	735	5	5	1040	130	5	0	5	20		125
PHF	.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
Flow rate	256	817	6	6	1156	144	6	0	6	22		139
Flare storage (# of vehs)									0			0
Median storage (# of vehs)							0			0		

Signal upstream of Movement 2 ________ ft Movement 6 ________ 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	LTR	13	8	1.631	3	1191.2	F	1191.2
	2								
	3								F
WB	1	R	125	238	.524	3	35.6	E	188.8
	2	L	22	12	1.882	4	1059.1	F	
	3								F
		1	256	530	.483	3	18	C	
		4	6	803	.007	<1	9.5	A	

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CHAPTER 17 - TWSC - UNSIGNALIZED INTERSECTIONS WORKSHEET

Analysis Summary

General Information

Analyst	TL	Jurisdiction/Date	KULA, MAUI 12/23/200
Agency or Company	ATA	Major Street	KULA HWY
Analysis Period/Year	PM PEAK HOUR 2005	Minor Street	KKHS DRWY
Comment	BASE YEAR 2005		

Input Data

Lane Configuration	SB	NB	EB	WB
Lane 1 (curb)	TR	R	LTR	R
Lane 2	L	LT		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)	20	770	5	5	850	5	5	0	5	10		30
PHF	.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
Flow rate	22	856	6	6	944	6	6	0	6	11		33
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
EB	1	LTR	13	81	.16	1	57.4	F	57.4
	2								
	3								F
WB	1	R	33	316	.104	<1	17.7	C	35.8
	2	L	11	53	.208	1	90.1	F	
	3								E
		1	22	719	.031	<1	10.2	B	
		4	6	776	.007	<1	9.7	A	

HICAP 2000 ™
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Institute for Astronomy
Base Year 2005 with traffic signal system
AM Peak Hour of Traffic

12/24/03
11:16:24

SIGNAL2000/TEAPAC[Ver 1.11.00] - Capacity Analysis Summary

Intersection Averages for Int # 0 - Kula Hwy/A'Apueo Pkwy
Degree of Saturation (v/c) 0.60 Vehicle Delay 17.8 Level of Service B

```
        --------------------------
Sq 11 |  Phase 1   |  Phase 2  |
**/** --------------------------
      | + +        | +         |
  .   | + +        | +         |
 /|\  |<+ +        |<+         |
  |   |   v        |     ^     |
  |   |        ^   |****       |
North |     <+ *   |           |
  |   |      + *   |++++       |
      |      + *   |   v       |
      --------------------------
      | G/C=0.600  | G/C=0.289 |
      | G= 54.0"   | G= 26.0"  |
      | Y+R= 5.0"  | Y+R= 5.0" |
      | OFF= 0.0%  | OFF=65.6% |
      --------------------------
     C= 90 sec   G= 80.0 sec = 88.9%  Y=10.0 sec = 11.1%  Ped= 0.0 sec =  0.0%
```

Lane Group	Width/ Lanes	g/C Reqd	g/C Used	Service Rate @C (vph)	Service Rate @E	Adj Volume	v/c	HCM Delay	L S	Queue Model 1
SB Approach								8.0	A	
RT	12/1	0.340	1.000	1583	1583	372	0.235	0.3	A	24 ft
TH	12/1	0.336	0.600	1032	1118	483	0.432	13.8	B+	389 ft
NB Approach								21.0	C+	
TH	12/1	0.551	0.600	1073	1118	967	0.865	22.2	*C+	924 ft
LT	12/1	0.245	0.600	369	417	100	0.240	8.7	A	58 ft
EB Approach								30.2	C	
RT	12/1	0.169	0.289	297	457	72	0.158	24.6	C+	69 ft
LT	12/1	0.268	0.289	382	511	339	0.663	31.4	*C	351 ft

Institute for Astronomy
Base Year 2005 with traffic signal system
AM Peak Hour of Traffic

12/24/03
11:16:16

SIGNAL2000/TEAPAC[Ver 1.11.00] - Summary of Parameter Values

Intersection Parameters for Int # 0 - Kula Hwy/A'Apueo Pkwy

METROAREA	NONCBD			
SIMULATION PERIOD	15			
LEVELOFSERVICE	C	S		
NODELOCATION	0	0		
QUEUEMODELS	1	90	25	40

Approach Parameters

APPLABELS	SB	WB	NB	EB
GRADES	0.0	0.0	0.0	0.0
PEDLEVELS	0	0	0	0
BIKEVOLUMES	0	0	0	0
PARKINGSIDES	NONE	NONE	NONE	NONE
PARKVOLUMES	20	20	20	20
BUSVOLUMES	0	0	0	0
RIGHTTURNONREDS	0	0	0	0
UPSTREAMVC	0.00	0.00	0.00	0.00

Movement Parameters

MOVLABELS	RT	TH	LT	RT	TH	LT	RT	TH	LT	RT	TH	LT
VOLUMES	335	435	0	0	0	0	0	870	90	65	0	305
WIDTHS	12.0	12.0	0.0	0.0	0.0	0.0	0.0	12.0	12.0	12.0	0.0	12.0
LANES	1	1	0	0	0	0	0	1	1	1	0	1
GROUPTYPES	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM
UTILIZATIONS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRUCKPERCENTS	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
PEAKHOURFACTORS	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
ARRIVALTYPES	2	2	2	3	3	3	3	3	3	3	3	3
ACTUATIONS	NO	YES	YES	NO	YES	YES	NO	YES	YES	NO	YES	YES
REQCLEARANCES	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
MINIMUMS	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
STARTUPLOST	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
ENDGAIN	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
STORAGE	0	0	0	0	0	0	0	0	0	0	0	0
INITIALQUEUE	0	0	0	0	0	0	0	0	0	0	0	0
IDEALSATFLOWS	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
FACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
DELAYFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
NSTOPFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
SATURATIONFLOWS	1583	1863	0	0	0	0	0	1863	866	1583	0	1770

Phasing Parameters

SEQUENCES	11	11					
PERMISSIVES	NO	NO	NO	NO	LEADLAGS	NONE	NONE
OVERLAPS	YES	YES	YES	YES	OFFSET	0.00	1
CYCLES	90	180	90		PEDTIME	0.0	0
GREENTIMES	54.00	26.00					
YELLOWTIMES	5.00	5.00					
CRITICALS	8	12					
EXCESS	0						

Institute for Astronomy
Base Year 2005 with traffic signal system
PM Peak Hour of Traffic

12/24/03
11:16:56

SIGNAL2000/TEAPAC[Ver 1.11.00] - Capacity Analysis Summary

Intersection Averages for Int # 0 - Kula Hwy/A'Apueo Pkwy
Degree of Saturation (v/c) 0.58 Vehicle Delay 13.6 Level of Service B+

```
Sq 11 | Phase 1  | Phase 2  |
**/** ------------------------
      | + *      | +        |
      | + *      | +        |
 /|\  |<+ *      |<+        |
  |   |  v       |    ^     |
  |   |      ^   |****      |
North |   <+ +   |          |
  |   |    + +   |++++      |
      |    + +   |   v      |
      ------------------------
      | G/C=0.517 | G/C=0.317 |
      | G= 31.0"  | G= 19.0"  |
      | Y+R= 5.0" | Y+R= 5.0" |
      | OFF= 0.0% | OFF=60.0% |
      ------------------------
C= 60 sec   G= 50.0 sec = 83.3%  Y=10.0 sec = 16.7%  Ped= 0.0 sec = 0.0%
```

Lane Group	Width/ Lanes	g/C Reqd	g/C Used	Service Rate @C (vph)	Service Rate @E	Adj Volume	v/c	HCM Delay	L S	Queue Model 1
SB Approach								12.8	B+	
RT	12/1	0.171	1.000	1583	1583	178	0.112	0.1	A	8 ft
TH	12/1	0.396	0.517	912	962	672	0.699	16.1	*B	448 ft
NB Approach								11.8	B+	
TH	12/1	0.363	0.517	929	962	617	0.641	11.9	B+	352 ft
LT	12/1	0.000	0.517	173	209	28	0.134	7.8	A	12 ft
EB Approach								18.4	B	
RT	12/1	0.081	0.317	423	501	50	0.100	14.9	B+	32 ft
LT	12/1	0.229	0.317	496	560	333	0.595	19.0	*B	226 ft

Institute for Astronomy
Base Year 2005 with traffic signal system
PM Peak Hour of Traffic

12/24/03
11:16:51

SIGNAL2000/TEAPAC[Ver 1.11.00] - Summary of Parameter Values

Intersection Parameters for Int # 0 - Kula Hwy/A'Apueo Pkwy

METROAREA	NONCBD			
SIMULATION PERIOD	15			
LEVELOFSERVICE	C	S		
NODELOCATION	0	0		
QUEUEMODELS	1	90	25	40

Approach Parameters

APPLABELS	SB	WB	NB	EB
GRADES	0.0	0.0	0.0	0.0
PEDLEVELS	0	0	0	0
BIKEVOLUMES	0	0	0	0
PARKINGSIDES	NONE	NONE	NONE	NONE
PARKVOLUMES	20	20	20	20
BUSVOLUMES	0	0	0	0
RIGHTTURNONREDS	0	0	0	0
UPSTREAMVC	0.00	0.00	0.00	0.00

Movement Parameters

MOVLABELS	RT	TH	LT	RT	TH	LT	RT	TH	LT	RT	TH	LT
VOLUMES	160	605	0	0	0	0	0	555	25	45	0	300
WIDTHS	12.0	12.0	0.0	0.0	0.0	0.0	0.0	12.0	12.0	12.0	0.0	12.0
LANES	1	1	0	0	0	0	0	1	1	1	0	1
GROUPTYPES	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM
UTILIZATIONS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRUCKPERCENTS	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
PEAKHOURFACTORS	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
ARRIVALTYPES	2	2	2	3	3	3	3	3	3	3	3	3
ACTUATIONS	NO	YES	YES	NO	YES	YES	NO	YES	YES	NO	YES	YES
REQCLEARANCES	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
MINIMUMS	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
STARTUPLOST	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
ENDGAIN	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
STORAGE	0	0	0	0	0	0	0	0	0	0	0	0
INITIALQUEUE	0	0	0	0	0	0	0	0	0	0	0	0
IDEALSATFLOWS	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
FACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
DELAYFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
NSTOPFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
SATURATIONFLOWS	1583	1863	0	0	0	0	0	1863	544	1583	0	1770

Phasing Parameters

SEQUENCES	11	11			LEADLAGS	NONE	NONE
PERMISSIVES	NO	NO	NO	NO	OFFSET	0.00	1
OVERLAPS	YES	YES	YES	YES	PEDTIME	0.0	0
CYCLES	60	180	60				
GREENTIMES	31.00	19.00					
YELLOWTIMES	5.00	5.00					
CRITICALS	2	12					
EXCESS	0						

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CIVIL ENGINEERS • SURVEYORS

APPENDIX C

LEVEL OF SERVICE CALCULATIONS

- Base Year 2005 with Mitigative Measures

Institute for Astronomy
AM Peak Hour of Traffic
Base Year 2005 with traffic signal

12/26/03
08:35:01

SIGNAL2000/TEAPAC[Ver 1.11.00] - Capacity Analysis Summary

Intersection Averages for Int # 0 - Haleakala Highway/Old Haleakal
Degree of Saturation (v/c) 1.21 Vehicle Delay 197.9 Level of Service F

```
      ---------------------------
Sq 11 |  Phase 1  |  Phase 2  |
**/** ---------------------------
      |           |           |
 /|\  |           |      <****|
  |   |           |           |
  |   |           |           |
North |    <*     |++++>      |
  |   |     *     |           |
      |     *     |           |
      ---------------------------
      | G/C=0.372 | G/C=0.572 |
      | G= 67.0"  | G= 103.0" |
      | Y+R= 5.0" | Y+R= 5.0" |
      | OFF= 0.0% | OFF=40.0% |
      ---------------------------
      C=180 sec   G=170.0 sec = 94.4%  Y=10.0 sec = 5.6%  Ped= 0.0 sec = 0.0%
```

Lane Group	Width/ Lanes	g/C Reqd	g/C Used	Service Rate @C (vph)	Service Rate @E	Adj Volume	v/c	HCM Delay	L S	Queue Model 1
NB Approach								230.7	F	
LT	12/1	0.604	0.372	1	631	900	1.366	230.7	*F	2776 ft
WB Approach								217.5	F	
TH	12/1	0.842	0.572	649	1066	1444	1.355	217.5	*F	4370 ft
EB Approach								18.2	B	
TH	24/2	0.406	0.572	1700	2025	322	0.159	18.2	B	183 ft

Institute for Astronomy
AM Peak Hour of Traffic
Base Year 2005 with traffic signal

12/26/03
08:31:29

SIGNAL2000/TEAPAC[Ver 1.11.00] - Summary of Parameter Values

Intersection Parameters for Int # 0 - Haleakala Highway/Old Haleakal

METROAREA	NONCBD			
SIMULATION PERIOD	15			
LEVELOFSERVICE	C	S		
NODELOCATION	0	0		
QUEUEMODELS	1	90	25	40

Approach Parameters

APPLABELS	SB	WB	NB	EB
GRADES	0.0	0.0	0.0	0.0
PEDLEVELS	0	0	0	0
BIKEVOLUMES	0	0	0	0
PARKINGSIDES	NONE	NONE	NONE	NONE
PARKVOLUMES	20	20	20	20
BUSVOLUMES	0	0	0	0
RIGHTTURNONREDS	0	0	0	0
UPSTREAMVC	0.00	0.00	0.00	0.00

Movement Parameters

MOVLABELS	RT	TH	LT	RT	TH	LT	RT	TH	LT	RT	TH	LT
VOLUMES	0	0	0	0	1300	0	5	0	810	250	290	0
WIDTHS	0.0	0.0	0.0	0.0	12.0	0.0	12.0	0.0	12.0	12.0	24.0	0.0
LANES	0	0	0	0	1	0	1	0	1	1	2	0
GROUPTYPES	NORM	NORM	NORM	NORM	NORM	NORM	FFLW	NORM	NORM	FFLW	NORM	NORM
UTILIZATIONS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRUCKPERCENTS	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
PEAKHOURFACTORS	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
ARRIVALTYPES	3	3	3	2	2	2	3	3	3	3	3	3
ACTUATIONS	NO	YES	YES	NO	YES	YES	NO	YES	YES	NO	YES	YES
REQCLEARANCES	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
MINIMUMS	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
STARTUPLOST	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
ENDGAIN	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
STORAGE	0	0	0	0	0	0	0	0	0	0	0	0
INITIALQUEUE	0	0	0	0	0	0	0	0	0	0	0	0
IDEALSATFLOWS	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
FACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
DELAYFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
NSTOPFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
SATURATIONFLOWS	0	0	0	0	1863	0	0	0	1770	0	3539	0

Phasing Parameters

SEQUENCES	11	11					
PERMISSIVES	YES	YES	YES	YES	LEADLAGS	NONE	NONE
OVERLAPS	YES	YES	YES	YES	OFFSET	0.00	1
CYCLES	90	180	90		PEDTIME	0.0	0
GREENTIMES	67.00	103.00					
YELLOWTIMES	5.00	5.00					
CRITICALS	9	5					
EXCESS	0						

```
Institute for Astronomy                                      12/26/03
PM Peak Hour of Traffic                                      08:38:48
Base Year 2005 with traffic signal

SIGNAL2000/TEAPAC[Ver 1.11.00] - Capacity Analysis Summary

Intersection Averages for Int #    0 - Haleakala Highway/Old Haleakal
     Degree of Saturation (v/c) 0.59  Vehicle Delay  13.7  Level of Service B+

        -------------------------
Sq 11 |  Phase 1  |  Phase 2  |
**/** -------------------------
        |           |           |
  /|\   |           |           |
   |    |           |      <****|
   |    |           |           |
North   |    <*     |++++>      |
   |    |     *     |           |
        |     *     |           |
        -------------------------
        | G/C=0.300 | G/C=0.533 |
        | G= 18.0"  | G= 32.0"  |
        | Y+R= 5.0" | Y+R= 5.0" |
        | OFF= 0.0% | OFF=38.3% |
        -------------------------
  C= 60 sec   G= 50.0 sec = 83.3%  Y=10.0 sec = 16.7%  Ped= 0.0 sec =  0.0%

--------------------------------------------------------------------------------
| Lane   |Width/|      g/C      | Service Rate|  Adj |       |  HCM  | L | Queue |
| Group  | Lanes| Reqd    Used  | @C (vph) @E |Volume|  v/c  | Delay | S |Model 1|
--------------------------------------------------------------------------------
NB Approach                                                20.8    C+
================================================================================
|  LT    | 12/1 |0.232 |0.300 |  465 |  531 |  339 |0.638 |  20.8 |*C+| 238 ft|
--------------------------------------------------------------------------------
WB Approach                                                16.3    B
================================================================================
|  TH    | 12/1 |0.418 |0.533 |  945 |  993 |  717 |0.722 |  16.3 |*B | 481 ft|
--------------------------------------------------------------------------------
EB Approach                                                 8.9    A
================================================================================
|  TH    | 24/2 |0.270 |0.533 | 1888 | 1888 |  878 |0.465 |   8.9 | A | 227 ft|
--------------------------------------------------------------------------------
```

```
Institute for Astronomy                                      12/26/03
PM Peak Hour of Traffic                                      08:38:53
Base Year 2005 with traffic signal

SIGNAL2000/TEAPAC[Ver 1.11.00] - Summary of Parameter Values

  Intersection Parameters for Int #   0 - Haleakala Highway/Old Haleakal
METROAREA              NONCBD
SIMULATION PERIOD          15
LEVELOFSERVICE         C    S
NODELOCATION           0    0
QUEUEMODELS     1  90  25  40

  Approach Parameters
APPLABELS              SB                 WB                 NB                 EB
GRADES                0.0                0.0                0.0                0.0
PEDLEVELS               0                  0                  0                  0
BIKEVOLUMES             0                  0                  0                  0
PARKINGSIDES         NONE               NONE               NONE               NONE
PARKVOLUMES            20                 20                 20                 20
BUSVOLUMES              0                  0                  0                  0
RIGHTTURNONREDS         0                  0                  0                  0
UPSTREAMVC           0.00               0.00               0.00               0.00

  Movement Parameters
MOVLABELS          RT   TH   LT     RT   TH   LT     RT   TH   LT     RT   TH   LT
VOLUMES             0    0    0      0  645    0      5    0  305    650  790    0
WIDTHS            0.0  0.0  0.0    0.0 12.0  0.0   12.0  0.0 12.0   12.0 24.0  0.0
LANES               0    0    0      0    1    0      1    0    1      1    2    0
GROUPTYPES       NORM NORM NORM   NORM NORM NORM   FFLW NORM NORM   FFLW NORM NORM
UTILIZATIONS     0.00 0.00 0.00   0.00 0.00 0.00   0.00 0.00 0.00   0.00 0.00 0.00
TRUCKPERCENTS     2.0  2.0  2.0    2.0  2.0  2.0    2.0  2.0  2.0    2.0  2.0  2.0
PEAKHOURFACTORS  0.90 0.90 0.90   0.90 0.90 0.90   0.90 0.90 0.90   0.90 0.90 0.90
ARRIVALTYPES        3    3    3      2    2    2      3    3    3      3    3    3
ACTUATIONS         NO  YES  YES     NO  YES  YES     NO  YES  YES     NO  YES  YES
REQCLEARANCES     5.0  5.0  5.0    5.0  5.0  5.0    5.0  5.0  5.0    5.0  5.0  5.0
MINIMUMS          5.0  5.0  5.0    5.0  5.0  5.0    5.0  5.0  5.0    5.0  5.0  5.0
STARTUPLOST       2.0  2.0  2.0    2.0  2.0  2.0    2.0  2.0  2.0    2.0  2.0  2.0
ENDGAIN           2.0  2.0  2.0    2.0  2.0  2.0    2.0  2.0  2.0    2.0  2.0  2.0
STORAGE             0    0    0      0    0    0      0    0    0      0    0    0
INITIALQUEUE        0    0    0      0    0    0      0    0    0      0    0    0
IDEALSATFLOWS    1900 1900 1900   1900 1900 1900   1900 1900 1900   1900 1900 1900
FACTORS          1.00 1.00 1.00   1.00 1.00 1.00   1.00 1.00 1.00   1.00 1.00 1.00
DELAYFACTORS     1.00 1.00 1.00   1.00 1.00 1.00   1.00 1.00 1.00   1.00 1.00 1.00
NSTOPFACTORS     1.00 1.00 1.00   1.00 1.00 1.00   1.00 1.00 1.00   1.00 1.00 1.00
SATURATIONFLOWS     0    0    0      0 1863    0      0    0 1770      0 3539    0

  Phasing Parameters
SEQUENCES          11    11
PERMISSIVES       YES   YES    YES    YES          LEADLAGS        NONE   NONE
OVERLAPS          YES   YES    YES    YES          OFFSET          0.00      1
CYCLES             60   180     60                 PEDTIME          0.0      0
GREENTIMES      18.00 32.00
YELLOWTIMES      5.00  5.00
CRITICALS           9     5
EXCESS              0
```

Institute for Astronomy
AM Peak Hour of Traffic
Base Year 2005 with traffic signal

12/26/03
08:30:04

SIGNAL2000/TEAPAC[Ver 1.11.00] - Capacity Analysis Summary

Intersection Averages for Int # 0 - Haleakala Highway/Old Haleakal
Degree of Saturation (v/c) 0.72 Vehicle Delay 8.3 Level of Service A

```
        --------------------------
Sq  0 | Phase 1  | Phase 2  |
**/** --------------------------
      |          |          |
 /|\  |     <++++|    <++++|
  |   |          |          |
  |   |          |          |
North |   <*     |++++>     |
  |   |    *     |          |
      |    *     |          |
      --------------------------
      | G/C=0.733 | G/C=0.156 |
      | G= 66.0"  | G= 14.0"  |
      | Y+R= 5.0" | Y+R= 5.0" |
      | OFF= 0.0% | OFF=78.9% |
      --------------------------
```

C= 90 sec G= 80.0 sec = 88.9% Y=10.0 sec = 11.1% Ped= 0.0 sec = 0.0%

Lane Group	Width/ Lanes	g/C Reqd	g/C Used	Service Rate @C (vph)	Service Rate @E	Adj Volume	v/c	HCM Delay	L S	Queue Model 1
NB Approach								8.1	A	
LT	12/1	0.543	0.733	1289	1298	900	0.693	8.1	*A	565 ft
WB Approach								2.1	A	
TH	12/1	0.797	1.000	1863	1863	1444	0.775	2.1	*A	143 ft
EB Approach								36.9	D+	
TH	24/2	0.170	0.156	242	551	322	0.584	36.9	D+	191 ft

Institute for Astronomy
AM Peak Hour of Traffic
Base Year 2005 with traffic signal

12/26/03
08:29:33

SIGNAL2000/TEAPAC[Ver 1.11.00] - Summary of Parameter Values

Intersection Parameters for Int # 0 - Haleakala Highway/Old Haleakal

METROAREA	NONCBD			
SIMULATION PERIOD	15			
LEVELOFSERVICE	C	S		
NODELOCATION	0	0		
QUEUEMODELS	1	90	25	40

Approach Parameters

APPLABELS	SB	WB	NB	EB
GRADES	0.0	0.0	0.0	0.0
PEDLEVELS	0	0	0	0
BIKEVOLUMES	0	0	0	0
PARKINGSIDES	NONE	NONE	NONE	NONE
PARKVOLUMES	20	20	20	20
BUSVOLUMES	0	0	0	0
RIGHTTURNONREDS	0	0	0	0
UPSTREAMVC	0.00	0.00	0.00	0.00

Movement Parameters

MOVLABELS	RT	TH	LT	RT	TH	LT	RT	TH	LT	RT	TH	LT
VOLUMES	0	0	0	0	1300	0	5	0	810	250	290	0
WIDTHS	0.0	0.0	0.0	0.0	12.0	0.0	12.0	0.0	12.0	12.0	24.0	0.0
LANES	0	0	0	0	1	0	1	0	1	1	2	0
GROUPTYPES	NORM	NORM	NORM	NORM	NORM	NORM	FFLW	NORM	NORM	FFLW	NORM	NORM
UTILIZATIONS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRUCKPERCENTS	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
PEAKHOURFACTORS	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
ARRIVALTYPES	3	3	3	2	2	2	3	3	3	3	3	3
ACTUATIONS	NO	YES	YES	NO	YES	YES	NO	YES	YES	NO	YES	YES
REQCLEARANCES	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
MINIMUMS	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
STARTUPLOST	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
ENDGAIN	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
STORAGE	0	0	0	0	0	0	0	0	0	0	0	0
INITIALQUEUE	0	0	0	0	0	0	0	0	0	0	0	0
IDEALSATFLOWS	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
FACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
DELAYFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
NSTOPFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
SATURATIONFLOWS	0	0	0	0	1863	0	0	0	1770	0	3539	0

```
Institute for Astronomy                                              12/26/03
AM Peak Hour of Traffic                                              08:29:33
Base Year 2005 with traffic signal

SIGNAL2000/TEAPAC[Ver 1.11.00] - Summary of Parameter Values

  Phasing Parameters
SEQUENCES            0     0
PERMISSIVES        YES   YES   YES   YES      LEADLAGS      NONE   NONE
OVERLAPS           YES   YES   YES   YES      OFFSET        0.00      1
CYCLES              60   180    10            PEDTIME        0.0      0
GREENTIMES       66.00 14.00
YELLOWTIMES       5.00  5.00
CRITICALS            9     5
EXCESS               0
PHASEMOVEMENTS       1     9     5     0     0     0     0
PHASEMOVEMENTS       2     5    11     0     0     0     0
PHASEMOVEMENTS       3     0     0     0     0     0     0
PHASEMOVEMENTS       4     0     0     0     0     0     0
PHASEMOVEMENTS       5     0     0     0     0     0     0
PHASEMOVEMENTS       6     0     0     0     0     0     0
```

```
Institute for Astronomy                                              12/26/03
PM Peak Hour of Traffic                                              08:38:22
Base Year 2005 with traffic signal

SIGNAL2000/TEAPAC[Ver 1.11.00] - Capacity Analysis Summary

Intersection Averages for Int #   0 - Haleakala Highway/Old Haleakal
     Degree of Saturation (v/c) 0.47  Vehicle Delay   7.7   Level of Service A

      -------------------------
Sq  0 |  Phase 1  |  Phase 2  |
**/** -------------------------
      |           |           |
  /|\ |           |           |
   |  |     <++++|      <****|
   |  |           |           |
North |   <*      |++++>      |
   |  |    *      |           |
      |    *      |           |
      -------------------------
      | G/C=0.300 | G/C=0.533 |
      | G=  18.0" | G=  32.0" |
      | Y+R= 5.0" | Y+R= 5.0" |
      | OFF= 0.0% | OFF=38.3% |
      -------------------------
      C= 60 sec   G= 50.0 sec = 83.3%  Y=10.0 sec = 16.7%  Ped= 0.0 sec =  0.0%

--------------------------------------------------------------------------------
| Lane   |Width/|     g/C     | Service Rate|  Adj  |       |  HCM  | L | Queue |
|  Group | Lanes| Reqd   Used | @C (vph) @E |Volume|   v/c | Delay | S |Model 1|
--------------------------------------------------------------------------------
NB Approach                                                   20.8   C+
================================================================================
|   LT   | 12/1 |0.232 |0.300 |  465 |  531 |  339 |0.638 |  20.8 |*C+| 238 ft|
--------------------------------------------------------------------------------
WB Approach                                                    0.1   A
================================================================================
|   TH   | 12/1 |0.418 |1.000 | 1863 | 1863 |  717 |0.385 |   0.1 |*A |  22 ft|
--------------------------------------------------------------------------------
EB Approach                                                    8.9   A
================================================================================
|   TH   | 24/2 |0.270 |0.533 | 1888 | 1888 |  878 |0.465 |   8.9 | A | 227 ft|
--------------------------------------------------------------------------------
```

Institute for Astronomy
PM Peak Hour of Traffic
Base Year 2005 with traffic signal

12/26/03
08:38:28

SIGNAL2000/TEAPAC[Ver 1.11.00] - Summary of Parameter Values

Intersection Parameters for Int # 0 - Haleakala Highway/Old Haleakal

METROAREA	NONCBD			
SIMULATION PERIOD	15			
LEVELOFSERVICE	C	S		
NODELOCATION	0	0		
QUEUEMODELS	1	90	25	40

Approach Parameters

APPLABELS	SB	WB	NB	EB
GRADES	0.0	0.0	0.0	0.0
PEDLEVELS	0	0	0	0
BIKEVOLUMES	0	0	0	0
PARKINGSIDES	NONE	NONE	NONE	NONE
PARKVOLUMES	20	20	20	20
BUSVOLUMES	0	0	0	0
RIGHTTURNONREDS	0	0	0	0
UPSTREAMVC	0.00	0.00	0.00	0.00

Movement Parameters

MOVLABELS	RT	TH	LT	RT	TH	LT	RT	TH	LT	RT	TH	LT
VOLUMES	0	0	0	0	645	0	5	0	305	650	790	0
WIDTHS	0.0	0.0	0.0	0.0	12.0	0.0	12.0	0.0	12.0	12.0	24.0	0.0
LANES	0	0	0	0	1	0	1	0	1	1	2	0
GROUPTYPES	NORM	NORM	NORM	NORM	NORM	NORM	FFLW	NORM	NORM	FFLW	NORM	NORM
UTILIZATIONS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRUCKPERCENTS	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
PEAKHOURFACTORS	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
ARRIVALTYPES	3	3	3	2	2	2	3	3	3	3	3	3
ACTUATIONS	NO	YES	YES	NO	YES	YES	NO	YES	YES	NO	YES	YES
REQCLEARANCES	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
MINIMUMS	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
STARTUPLOST	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
ENDGAIN	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
STORAGE	0	0	0	0	0	0	0	0	0	0	0	0
INITIALQUEUE	0	0	0	0	0	0	0	0	0	0	0	0
IDEALSATFLOWS	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
FACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
DELAYFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
NSTOPFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
SATURATIONFLOWS	0	0	0	0	1863	0	0	0	1770	0	3539	0

Institute for Astronomy
PM Peak Hour of Traffic
Base Year 2005 with traffic signal

12/26/03
08:38:28

SIGNAL2000/TEAPAC[Ver 1.11.00] - Summary of Parameter Values

Phasing Parameters

SEQUENCES	0	0					
PERMISSIVES	YES	YES	YES	YES			
OVERLAPS	YES	YES	YES	YES			
CYCLES	60	180	10				
GREENTIMES	18.00	32.00					
YELLOWTIMES	5.00	5.00					
CRITICALS	9	5					
EXCESS	0						
PHASEMOVEMENTS	1	9	5	0	0	0	0
PHASEMOVEMENTS	2	5	11	0	0	0	0
PHASEMOVEMENTS	3	0	0	0	0	0	0
PHASEMOVEMENTS	4	0	0	0	0	0	0
PHASEMOVEMENTS	5	0	0	0	0	0	0
PHASEMOVEMENTS	6	0	0	0	0	0	0

LEADLAGS	NONE	NONE
OFFSET	0.00	1
PEDTIME	0.0	0

ATA AUSTIN, TSUTSUMI & ASSOCIATES, INC.
CIVIL ENGINEERS • SURVEYORS

APPENDIX C

LEVEL OF SERVICE CALCULATIONS

- Base Year 2005 with Phase 1

Institute for Astronomy
AM Peak Hour of Traffic
Year 2005 with Phase 1

12/26/03
08:48:27

SIGNAL2000/TEAPAC[Ver 1.11.00] - Capacity Analysis Summary

Intersection Averages for Int # 0 - Haleakala Highway/Old Haleakal
Degree of Saturation (v/c) 1.21 Vehicle Delay 197.5 Level of Service F

```
        ------------------------
Sq 11 | Phase 1  | Phase 2  |
**/** ------------------------
        |          |          |
  ^     |          |          |
 /|\    |          |    <****|
  |     |          |          |
  |     |          |          |
North   |    <*    |++++>     |
  |     |     *    |          |
        |     *    |          |
        ------------------------
        | G/C=0.372 | G/C=0.572 |
        | G=  67.0" | G= 103.0" |
        | Y+R= 5.0" | Y+R= 5.0" |
        | OFF= 0.0% | OFF=40.0% |
        ------------------------
C=180 sec   G=170.0 sec = 94.4%   Y=10.0 sec =  5.6%   Ped= 0.0 sec =  0.0%
```

Lane Group	Width/ Lanes	g/C Reqd	g/C Used	Service Rate @C (vph)	Service Rate @E	Adj Volume	v/c	HCM Delay	L S	Queue Model 1
NB Approach								230.7	F	
LT	12/1	0.604	0.372	1	631	900	1.366	230.7	*F	2776 ft
WB Approach								217.5	F	
TH	12/1	0.842	0.572	649	1066	1444	1.355	217.5	*F	4370 ft
EB Approach								18.2	B	
TH	24/2	0.407	0.572	1700	2025	328	0.162	18.2	B	187 ft

Institute for Astronomy
AM Peak Hour of Traffic
Year 2005 with Phase 1

12/26/03
08:48:32

SIGNAL2000/TEAPAC[Ver 1.11.00] - Summary of Parameter Values

Intersection Parameters for Int # 0 - Haleakala Highway/Old Haleakal

METROAREA	NONCBD			
SIMULATION PERIOD	15			
LEVELOFSERVICE	C	S		
NODELOCATION	0	0		
QUEUEMODELS	1	90	25	40

Approach Parameters

APPLABELS	SB	WB	NB	EB
GRADES	0.0	0.0	0.0	0.0
PEDLEVELS	0	0	0	0
BIKEVOLUMES	0	0	0	0
PARKINGSIDES	NONE	NONE	NONE	NONE
PARKVOLUMES	20	20	20	20
BUSVOLUMES	0	0	0	0
RIGHTTURNONREDS	0	0	0	0
UPSTREAMVC	0.00	0.00	0.00	0.00

Movement Parameters

MOVLABELS	RT	TH	LT	RT	TH	LT	RT	TH	LT	RT	TH	LT
VOLUMES	0	0	0	0	1300	0	5	0	810	250	295	0
WIDTHS	0.0	0.0	0.0	0.0	12.0	0.0	12.0	0.0	12.0	12.0	24.0	0.0
LANES	0	0	0	0	1	0	1	0	1	1	2	0
GROUPTYPES	NORM	NORM	NORM	NORM	NORM	NORM	FFLW	NORM	NORM	FFLW	NORM	NORM
UTILIZATIONS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRUCKPERCENTS	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
PEAKHOURFACTORS	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
ARRIVALTYPES	3	3	3	2	2	2	3	3	3	3	3	3
ACTUATIONS	NO	YES	YES	NO	YES	YES	NO	YES	YES	NO	YES	YES
REQCLEARANCES	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
MINIMUMS	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
STARTUPLOST	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
ENDGAIN	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
STORAGE	0	0	0	0	0	0	0	0	0	0	0	0
INITIALQUEUE	0	0	0	0	0	0	0	0	0	0	0	0
IDEALSATFLOWS	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
FACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
DELAYFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
NSTOPFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
SATURATIONFLOWS	0	0	0	0	1863	0	0	0	1770	0	3539	0

Phasing Parameters

SEQUENCES	11	11					
PERMISSIVES	YES	YES	YES	YES	LEADLAGS	NONE	NONE
OVERLAPS	YES	YES	YES	YES	OFFSET	0.00	1
CYCLES	90	180	90		PEDTIME	0.0	0
GREENTIMES	67.00	103.00					
YELLOWTIMES	5.00	5.00					
CRITICALS	9	5					
EXCESS	0						

Institute for Astronomy
PM Peak Hour of Traffic
Year 2005 with Phase 1

12/26/03
08:49:35

SIGNAL2000/TEAPAC[Ver 1.11.00] - Capacity Analysis Summary

Intersection Averages for Int # 0 - Haleakala Highway/Old Haleakal
Degree of Saturation (v/c) 0.59 Vehicle Delay 13.8 Level of Service B+

```
        -------------------------
Sq 11 |  Phase 1  |  Phase 2  |
**/** -------------------------
      |           |           |
 /|\  |           |      <****|
  |   |           |           |
  |   |           |           |
North |    <*     |++++>      |
  |   |     *     |           |
      |     *     |           |
      -------------------------
      | G/C=0.300 | G/C=0.533 |
      | G= 18.0"  | G= 32.0"  |
      | Y+R= 5.0" | Y+R= 5.0" |
      | OFF= 0.0% | OFF=38.3% |
      -------------------------
      C= 60 sec   G= 50.0 sec = 83.3%  Y=10.0 sec = 16.7%  Ped= 0.0 sec =  0.0%
```

Lane Group	Width/ Lanes	g/C Reqd	g/C Used	Service Rate @C (vph)	Service Rate @E	Adj Volume	v/c	HCM Delay	L S	Queue Model 1
NB Approach								20.8	C+	
LT	12/1	0.232	0.300	465	531	339	0.638	20.8	*C+	238 ft
WB Approach								16.4	B	
TH	12/1	0.421	0.533	945	993	722	0.727	16.4	*B	486 ft
EB Approach								8.9	A	
TH	24/2	0.271	0.533	1888	1888	883	0.468	8.9	A	228 ft

Institute for Astronomy
PM Peak Hour of Traffic
Year 2005 with Phase 1

12/26/03
08:49:41

SIGNAL2000/TEAPAC[Ver 1.11.00] - Summary of Parameter Values

Intersection Parameters for Int # 0 - Haleakala Highway/Old Haleakal

METROAREA	NONCBD			
SIMULATION PERIOD	15			
LEVELOFSERVICE	C	S		
NODELOCATION	0	0		
QUEUEMODELS	1	90	25	40

Approach Parameters

APPLABELS	SB	WB	NB	EB
GRADES	0.0	0.0	0.0	0.0
PEDLEVELS	0	0	0	0
BIKEVOLUMES	0	0	0	0
PARKINGSIDES	NONE	NONE	NONE	NONE
PARKVOLUMES	20	20	20	20
BUSVOLUMES	0	0	0	0
RIGHTTURNONREDS	0	0	0	0
UPSTREAMVC	0.00	0.00	0.00	0.00

Movement Parameters

MOVLABELS	RT	TH	LT	RT	TH	LT	RT	TH	LT	RT	TH	LT
VOLUMES	0	0	0	0	650	0	5	0	305	650	795	0
WIDTHS	0.0	0.0	0.0	0.0	12.0	0.0	12.0	0.0	12.0	12.0	24.0	0.0
LANES	0	0	0	0	1	0	1	0	1	1	2	0
GROUPTYPES	NORM	NORM	NORM	NORM	NORM	NORM	FFLW	NORM	NORM	FFLW	NORM	NORM
UTILIZATIONS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRUCKPERCENTS	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
PEAKHOURFACTORS	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
ARRIVALTYPES	3	3	3	2	2	2	3	3	3	3	3	3
ACTUATIONS	NO	YES	YES	NO	YES	YES	NO	YES	YES	NO	YES	YES
REQCLEARANCES	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
MINIMUMS	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
STARTUPLOST	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
ENDGAIN	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
STORAGE	0	0	0	0	0	0	0	0	0	0	0	0
INITIALQUEUE	0	0	0	0	0	0	0	0	0	0	0	0
IDEALSATFLOWS	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
FACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
DELAYFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
NSTOPFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
SATURATIONFLOWS	0	0	0	0	1863	0	0	0	1770	0	3539	0

Phasing Parameters

SEQUENCES	11	11					
PERMISSIVES	YES	YES	YES	YES	LEADLAGS	NONE	NONE
OVERLAPS	YES	YES	YES	YES	OFFSET	0.00	1
CYCLES	60	180	60		PEDTIME	0.0	0
GREENTIMES	18.00	32.00					
YELLOWTIMES	5.00	5.00					
CRITICALS	9	5					
EXCESS	0						

Institute for Astronomy
AM Peak Hour of Traffic
Year 2005 with Phase 1

12/26/03
08:47:26

SIGNAL2000/TEAPAC[Ver 1.11.00] - Capacity Analysis Summary

Intersection Averages for Int # 0 - Haleakala Highway/Old Haleakal
Degree of Saturation (v/c) 0.73 Vehicle Delay 8.4 Level of Service A

```
        ---------------------------
Sq  0 | Phase 1  |  Phase 2  |
**/** ---------------------------
      |          |           |
      |          |           |
 /|\  |    <++++|      <****|
  |   |          |           |
  |   |          |           |
North |    <*    |++++>      |
  |   |     *    |           |
      |     *    |           |
        ---------------------------
      | G/C=0.733 | G/C=0.156 |
      | G=  66.0" | G=  14.0" |
      | Y+R= 5.0" | Y+R= 5.0" |
      | OFF= 0.0% | OFF=78.9% |
        ---------------------------
```

C= 90 sec G= 80.0 sec = 88.9% Y=10.0 sec = 11.1% Ped= 0.0 sec = 0.0%

Lane Group	Width/ Lanes	g/C Reqd	g/C Used	Service Rate @C (vph)	Service Rate @E	Adj Volume	v/c	HCM Delay	L S	Queue Model 1
NB Approach								8.1	A	
LT	12/1	0.543	0.733	1289	1298	900	0.693	8.1	*A	565 ft
WB Approach								2.1	A	
TH	12/1	0.797	1.000	1863	1863	1444	0.775	2.1	*A	143 ft
EB Approach								37.1	D+	
TH	24/2	0.172	0.156	242	551	328	0.595	37.1	D+	195 ft

Institute for Astronomy
AM Peak Hour of Traffic
Year 2005 with Phase 1

12/26/03
08:47:36

SIGNAL2000/TEAPAC[Ver 1.11.00] - Summary of Parameter Values

Intersection Parameters for Int # 0 - Haleakala Highway/Old Haleakal

METROAREA	NONCBD			
SIMULATION PERIOD	15			
LEVELOFSERVICE	C	S		
NODELOCATION	0	0		
QUEUEMODELS	1	90	25	40

Approach Parameters

APPLABELS	SB	WB	NB	EB
GRADES	0.0	0.0	0.0	0.0
PEDLEVELS	0	0	0	0
BIKEVOLUMES	0	0	0	0
PARKINGSIDES	NONE	NONE	NONE	NONE
PARKVOLUMES	20	20	20	20
BUSVOLUMES	0	0	0	0
RIGHTTURNONREDS	0	0	0	0
UPSTREAMVC	0.00	0.00	0.00	0.00

Movement Parameters

MOVLABELS	RT	TH	LT	RT	TH	LT	RT	TH	LT	RT	TH	LT
VOLUMES	0	0	0	0	1300	0	5	0	810	250	295	0
WIDTHS	0.0	0.0	0.0	0.0	12.0	0.0	12.0	0.0	12.0	12.0	24.0	0.0
LANES	0	0	0	0	1	0	1	0	1	1	2	0
GROUPTYPES	NORM	NORM	NORM	NORM	NORM	NORM	FFLW	NORM	NORM	FFLW	NORM	NORM
UTILIZATIONS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRUCKPERCENTS	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
PEAKHOURFACTORS	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
ARRIVALTYPES	3	3	3	2	2	2	3	3	3	3	3	3
ACTUATIONS	NO	YES	YES	NO	YES	YES	NO	YES	YES	NO	YES	YES
REQCLEARANCES	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
MINIMUMS	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
STARTUPLOST	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
ENDGAIN	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
STORAGE	0	0	0	0	0	0	0	0	0	0	0	0
INITIALQUEUE	0	0	0	0	0	0	0	0	0	0	0	0
IDEALSATFLOWS	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
FACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
DELAYFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
NSTOPFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
SATURATIONFLOWS	0	0	0	0	1863	0	0	0	1770	0	3539	0

```
Institute for Astronomy                                   12/26/03
AM Peak Hour of Traffic                                   08:47:36
Year 2005 with Phase 1

SIGNAL2000/TEAPAC[Ver 1.11.00] - Summary of Parameter Values

   Phasing Parameters
SEQUENCES                0    0
PERMISSIVES            YES  YES  YES  YES        LEADLAGS      NONE  NONE
OVERLAPS               YES  YES  YES  YES        OFFSET        0.00     1
CYCLES                  60  180   10             PEDTIME        0.0     0
GREENTIMES           66.00 14.00
YELLOWTIMES           5.00  5.00
CRITICALS                9    5
EXCESS                   0
PHASEMOVEMENTS           1    9    5    0    0    0    0
PHASEMOVEMENTS           2    5   11    0    0    0    0
PHASEMOVEMENTS           3    0    0    0    0    0    0
PHASEMOVEMENTS           4    0    0    0    0    0    0
PHASEMOVEMENTS           5    0    0    0    0    0    0
PHASEMOVEMENTS           6    0    0    0    0    0    0
```

```
Institute for Astronomy                                            12/26/03
PM Peak Hour of Traffic                                            08:49:09
Year 2005 with Phase 1

SIGNAL2000/TEAPAC[Ver 1.11.00] - Capacity Analysis Summary

Intersection Averages for Int #   0 - Haleakala Highway/Old Haleakal
      Degree of Saturation (v/c) 0.47  Vehicle Delay   7.7   Level of Service A

        -------------------------
Sq  0 |  Phase 1  |  Phase 2  |
**/** -------------------------
      |           |           |
 /|\  |      <++++|      <****|
  |   |           |           |
  |   |           |           |
North |    <*     |++++>      |
  |   |     *     |           |
      |     *     |           |
        -------------------------
      | G/C=0.300 | G/C=0.533 |
      | G=  18.0" | G=  32.0" |
      | Y+R= 5.0" | Y+R= 5.0" |
      | OFF= 0.0% | OFF=38.3% |
        -------------------------
      C= 60 sec   G= 50.0 sec = 83.3%  Y=10.0 sec = 16.7%  Ped= 0.0 sec =  0.0%

---------------------------------------------------------------------------------
| Lane   |Width/|     g/C     | Service Rate|  Adj  |       |  HCM  | L | Queue |
| Group  | Lanes| Reqd   Used | @C (vph) @E |Volume|  v/c  | Delay | S |Model 1|
---------------------------------------------------------------------------------

NB Approach                                                    20.8   C+
=================================================================================
|  LT    | 12/1 |0.232 |0.300 |  465 |  531 |  339 |0.638 |  20.8 |*C+| 238 ft|
---------------------------------------------------------------------------------

WB Approach                                                     0.1   A
=================================================================================
|  TH    | 12/1 |0.421 |1.000 | 1863 | 1863 |  722 |0.388 |   0.1 |*A |  22 ft|
---------------------------------------------------------------------------------

EB Approach                                                     8.9   A
=================================================================================
|  TH    | 24/2 |0.271 |0.533 | 1888 | 1888 |  883 |0.468 |   8.9 | A | 228 ft|
---------------------------------------------------------------------------------
```

Institute for Astronomy
PM Peak Hour of Traffic
Year 2005 with Phase 1

12/26/03
08:49:17

SIGNAL2000/TEAPAC[Ver 1.11.00] - Summary of Parameter Values

Intersection Parameters for Int # 0 - Haleakala Highway/Old Haleakal

METROAREA	NONCBD			
SIMULATION PERIOD	15			
LEVELOFSERVICE	C	S		
NODELOCATION	0	0		
QUEUEMODELS	1	90	25	40

Approach Parameters

APPLABELS	SB	WB	NB	EB
GRADES	0.0	0.0	0.0	0.0
PEDLEVELS	0	0	0	0
BIKEVOLUMES	0	0	0	0
PARKINGSIDES	NONE	NONE	NONE	NONE
PARKVOLUMES	20	20	20	20
BUSVOLUMES	0	0	0	0
RIGHTTURNONREDS	0	0	0	0
UPSTREAMVC	0.00	0.00	0.00	0.00

Movement Parameters

MOVLABELS	RT	TH	LT	RT	TH	LT	RT	TH	LT	RT	TH	LT
VOLUMES	0	0	0	0	650	0	5	0	305	650	795	0
WIDTHS	0.0	0.0	0.0	0.0	12.0	0.0	12.0	0.0	12.0	12.0	24.0	0.0
LANES	0	0	0	0	1	0	1	0	1	1	2	0
GROUPTYPES	NORM	NORM	NORM	NORM	NORM	NORM	FFLW	NORM	NORM	FFLW	NORM	NORM
UTILIZATIONS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRUCKPERCENTS	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
PEAKHOURFACTORS	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
ARRIVALTYPES	3	3	3	2	2	2	3	3	3	3	3	3
ACTUATIONS	NO	YES	YES	NO	YES	YES	NO	YES	YES	NO	YES	YES
REQCLEARANCES	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
MINIMUMS	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
STARTUPLOST	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
ENDGAIN	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
STORAGE	0	0	0	0	0	0	0	0	0	0	0	0
INITIALQUEUE	0	0	0	0	0	0	0	0	0	0	0	0
IDEALSATFLOWS	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
FACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
DELAYFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
NSTOPFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
SATURATIONFLOWS	0	0	0	0	1863	0	0	0	1770	0	3539	0

Institute for Astronomy
PM Peak Hour of Traffic
Year 2005 with Phase 1

12/26/03
08:49:17

SIGNAL2000/TEAPAC[Ver 1.11.00] - Summary of Parameter Values

Phasing Parameters

SEQUENCES	0	0								
PERMISSIVES	YES	YES	YES	YES				LEADLAGS	NONE	NONE
OVERLAPS	YES	YES	YES	YES				OFFSET	0.00	1
CYCLES	60	180	10					PEDTIME	0.0	0
GREENTIMES	18.00	32.00								
YELLOWTIMES	5.00	5.00								
CRITICALS	9	5								
EXCESS	0									
PHASEMOVEMENTS	1	9	5	0	0	0	0			
PHASEMOVEMENTS	2	5	11	0	0	0	0			
PHASEMOVEMENTS	3	0	0	0	0	0	0			
PHASEMOVEMENTS	4	0	0	0	0	0	0			
PHASEMOVEMENTS	5	0	0	0	0	0	0			
PHASEMOVEMENTS	6	0	0	0	0	0	0			

Institute for Astronomy
AM Peak Hour of Traffic
Year 2005 with Phase 1

12/26/03
08:51:00

SIGNAL2000/TEAPAC[Ver 1.11.00] - Capacity Analysis Summary

Intersection Averages for Int # 0 - Haleakala Highway/Makani Road
Degree of Saturation (v/c) 0.71 Vehicle Delay 37.7 Level of Service D+

```
        -----------------------------
Sq 11 | Phase 1    | Phase 2      |
**/** -----------------------------
      | * + +      |           ^  |
      | * + +      |        ****  |
 /|\  |<* + +>     |       <****  |
  |   |   v        |     ^  ++++  |
  |   |        ^   |++++    v     |
North |    <+ + +> |++++>         |
  |   |     + + +  |++++          |
      |     + + +  |    v         |
        -----------------------------
      | G/C=0.289  | G/C=0.600    |
      | G=  26.0"  | G=  54.0"    |
      | Y+R= 5.0"  | Y+R= 5.0"    |
      | OFF= 0.0%  | OFF=34.4%    |
        -----------------------------
      C= 90 sec   G= 80.0 sec = 88.9%  Y=10.0 sec = 11.1%  Ped= 0.0 sec =  0.0%
```

Lane Group	Width/ Lanes	g/C Reqd	g/C Used	Service Rate @C (vph)	Service Rate @E	Adj Volume	v/c	HCM Delay	L S	Queue Model 1
SB Approach								41.6	D+	
RT	12/1	0.338	0.289	297	457	394	0.862	49.2	*D	481 ft
TH+LT	12/1	0.228	0.289	311	426	211	0.495	27.5	C+	207 ft
NB Approach								25.1	C+	
RT	12/1	0.189	0.289	297	457	106	0.232	25.6	C+	102 ft
TH+LT	12/1	0.160	0.289	381	509	117	0.230	24.6	C+	105 ft
WB Approach								46.1	D	
RT+TH	12/1	0.631	0.600	1025	1110	1089	0.981	46.9	*D	1324 ft
LT	12/1	0.134	0.600	555	630	22	0.035	10.3	B+	16 ft
EB Approach								11.8	B+	
RT+TH	24/2	0.167	0.600	2029	2117	306	0.145	11.0	B+	119 ft
LT	12/1	0.237	0.600	56	73	39	0.470	18.1	B	39 ft

Institute for Astronomy
AM Peak Hour of Traffic
Year 2005 with Phase 1

12/26/03
08:51:07

SIGNAL2000/TEAPAC[Ver 1.11.00] - Summary of Parameter Values

Intersection Parameters for Int # 0 - Haleakala Highway/Makani Road

```
METROAREA          NONCBD
SIMULATION PERIOD      15
LEVELOFSERVICE      C   S
NODELOCATION        0   0
QUEUEMODELS     1  90  25  40
```

Approach Parameters

APPLABELS	SB	WB	NB	EB
GRADES	0.0	0.0	0.0	0.0
PEDLEVELS	0	0	0	0
BIKEVOLUMES	0	0	0	0
PARKINGSIDES	NONE	NONE	NONE	NONE
PARKVOLUMES	20	20	20	20
BUSVOLUMES	0	0	0	0
RIGHTTURNONREDS	0	0	0	0
UPSTREAMVC	0.00	0.00	0.00	0.00

Movement Parameters

MOVLABELS	RT	TH	LT	RT	TH	LT	RT	TH	LT	RT	TH	LT
VOLUMES	355	100	90	45	935	20	95	90	15	5	270	35
WIDTHS	12.0	12.0	0.0	0.0	12.0	12.0	12.0	12.0	0.0	0.0	24.0	12.0
LANES	1	1	0	0	1	1	1	1	0	0	2	1
GROUPTYPES	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM
UTILIZATIONS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRUCKPERCENTS	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
PEAKHOURFACTORS	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
ARRIVALTYPES	3	3	3	2	2	2	3	3	3	2	2	2
ACTUATIONS	NO	YES	YES	NO	YES	YES	NO	YES	YES	NO	YES	YES
REQCLEARANCES	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
MINIMUMS	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
STARTUPLOST	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
ENDGAIN	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
STORAGE	0	0	0	0	0	0	0	0	0	0	0	0
INITIALQUEUE	0	0	0	0	0	0	0	0	0	0	0	0
IDEALSATFLOWS	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
FACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
DELAYFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
NSTOPFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
SATURATIONFLOWS	1583	1473	0	0	1850	1051	1583	1762	0	0	3529	138

Phasing Parameters

```
SEQUENCES       11    11
PERMISSIVES     NO    NO    NO    NO       LEADLAGS    NONE   NONE
OVERLAPS       YES   YES   YES   YES       OFFSET      0.00      1
CYCLES          90   180    10             PEDTIME      0.0      0
GREENTIMES   26.00 54.00
YELLOWTIMES   5.00  5.00
CRITICALS        1     5
EXCESS           0
```

Institute for Astronomy
PM Peak Hour of Traffic
Year 2005 with Phase 1

12/26/03
08:51:47

SIGNAL2000/TEAPAC[Ver 1.11.00] - Capacity Analysis Summary

Intersection Averages for Int # 0 - Haleakala Highway/Makani Road
Degree of Saturation (v/c) 0.41 Vehicle Delay 10.6 Level of Service B+

```
       ---------------------------
Sq 11 |  Phase 1    |  Phase 2   |
**/** ---------------------------
      | * + +       |         ^  |
  .   | * + +       |       ++++|
 /|\  |<* + +>      |      <++++|
  |   |   v         |    ^   ++++|
  |   |        ^    |****    v   |
North |     <+ + +> |++++>       |
  |   |      + + +  |++++        |
      |      + + +  |    v       |
       ---------------------------
      | G/C=0.183   | G/C=0.650  |
      | G=  11.0"   | G=  39.0"  |
      | Y+R= 5.0"   | Y+R= 5.0"  |
      | OFF= 0.0%   | OFF=26.7%  |
       ---------------------------
      C= 60 sec   G= 50.0 sec = 83.3%  Y=10.0 sec = 16.7%  Ped= 0.0 sec =  0.0%
```

Lane Group	Width/ Lanes	g/C Reqd	g/C Used	Service Rate @C (vph)	Service Rate @E	Adj Volume	v/c	HCM Delay	L S	Queue Model 1
SB Approach								22.9	C+	
RT	12/1	0.115	0.183	198	290	94	0.324	24.2	*C+	72 ft
TH+LT	12/1	0.076	0.183	256	327	83	0.254	21.4	C+	57 ft
NB Approach								21.4	C+	
RT	12/1	0.059	0.183	198	290	28	0.097	21.0	C+	21 ft
TH+LT	12/1	0.078	0.183	263	335	89	0.266	21.5	C+	62 ft
WB Approach								9.3	A	
RT+TH	12/1	0.407	0.650	1172	1203	689	0.573	9.5	A	395 ft
LT	12/1	0.000	0.650	395	437	33	0.076	5.9	A	16 ft
EB Approach								7.6	A	
RT+TH	24/2	0.220	0.650	2295	2295	689	0.300	6.9	A	183 ft
LT	12/1	0.438	0.650	291	332	178	0.536	10.2	*B+	111 ft

Institute for Astronomy
PM Peak Hour of Traffic
Year 2005 with Phase 1

12/26/03
08:51:53

SIGNAL2000/TEAPAC[Ver 1.11.00] - Summary of Parameter Values

Intersection Parameters for Int # 0 - Haleakala Highway/Makani Road

METROAREA	NONCBD			
SIMULATION PERIOD	15			
LEVELOFSERVICE	C	8		
NODELOCATION	0	0		
QUEUEMODELS	1	90	25	40

Approach Parameters

APPLABELS	SB	WB	NB	EB
GRADES	0.0	0.0	0.0	0.0
PEDLEVELS	0	0	0	0
BIKEVOLUMES	0	0	0	0
PARKINGSIDES	NONE	NONE	NONE	NONE
PARKVOLUMES	20	20	20	20
BUSVOLUMES	0	0	0	0
RIGHTTURNONREDS	0	0	0	0
UPSTREAMVC	0.00	0.00	0.00	0.00

Movement Parameters

MOVLABELS	RT	TH	LT	RT	TH	LT	RT	TH	LT	RT	TH	LT
VOLUMES	85	65	10	25	595	30	25	75	5	10	610	160
WIDTHS	12.0	12.0	0.0	0.0	12.0	12.0	12.0	12.0	0.0	0.0	24.0	12.0
LANES	1	1	0	0	1	1	1	1	0	0	2	1
GROUPTYPES	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM
UTILIZATIONS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRUCKPERCENTS	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
PEAKHOURFACTORS	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
ARRIVALTYPES	3	3	3	2	2	2	3	3	3	2	2	2
ACTUATIONS	NO	YES	YES	NO	YES	YES	NO	YES	YES	NO	YES	YES
REQCLEARANCES	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
MINIMUMS	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
STARTUPLOST	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
ENDGAIN	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
STORAGE	0	0	0	0	0	0	0	0	0	0	0	0
INITIALQUEUE	0	0	0	0	0	0	0	0	0	0	0	0
IDEALSATFLOWS	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
FACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
DELAYFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
NSTOPFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
SATURATIONFLOWS	1583	1782	0	0	1851	672	1583	1825	0	0	3531	511

Phasing Parameters

SEQUENCES	11	11					
PERMISSIVES	NO	NO	NO	NO	LEADLAGS	NONE	NONE
OVERLAPS	YES	YES	YES	YES	OFFSET	0.00	1
CYCLES	60	180	10		PEDTIME	0.0	0
GREENTIMES	11.00	39.00					
YELLOWTIMES	5.00	5.00					
CRITICALS	1	12					
EXCESS	0						

Institute for Astronomy
AM Peak Hour of Traffic
Year 2005 with Phase 1

12/23/03
13:59:01

SIGNAL2000/TEAPAC[Ver 1.11.00] - Capacity Analysis Summary

Intersection Averages for Int # 0 - Haleakala Highway/Makawao Aven
Degree of Saturation (v/c) 0.66 Vehicle Delay 39.3 Level of Service D+

```
       -------------------------------------------------------
Sq 16 |  Phase 1    |  Phase 2    |  Phase 3    |  Phase 4    |
**/** -------------------------------------------------------
      | + + *       | +           | +           |         ^   |
      | + + *       | +           | +           |        ++++ |
 /|\  |<+ + *>      |<+           |<+           |       <**** |
  |   |   v         |    ^   ****|    ^        |             |
  |   |       ^     |++++    v    |****         |             |
North |    <+ + +>|           +>|++++>        |++++>        |
  |   |     + + +  |           +  |++++         |++++         |
      |     + + +  |           +  |   v         |   v         |
      -------------------------------------------------------
      | G/C=0.256  | G/C=0.056  | G/C=0.033  | G/C=0.433  |
      | G=  23.0"  | G=   5.0"  | G=   3.0"  | G=  39.0"  |
      | Y+R= 5.0"  | Y+R= 5.0"  | Y+R= 5.0"  | Y+R= 5.0"  |
      | OFF= 0.0%  | OFF=31.1%  | OFF=42.2%  | OFF=51.1%  |
      -------------------------------------------------------
      C= 90 sec   G= 70.0 sec = 77.8%  Y=20.0 sec = 22.2%  Ped= 0.0 sec =  0.0%
```

Lane Group	Width/ Lanes	g/C Reqd	g/C Used	Service Rate @C (vph)	Service Rate @E	Adj Volume	v/c	HCM Delay	L S	Queue Model 1
SB Approach								37.6	D+	
RT	12/1	0.293	0.456	623	721	306	0.424	18.4	B	244 ft
TH	12/1	0.234	0.256	335	476	289	0.607	31.8	C	299 ft
LT	12/1	0.315	0.256	217	323	300	0.920	62.9	*E+	402 ft
NB Approach								26.1	C+	
RT	12/1	0.128	0.367	451	581	11	0.019	18.2	B	10 ft
TH	12/1	0.155	0.256	335	476	111	0.233	26.8	C+	104 ft
LT	12/1	0.157	0.256	111	171	33	0.180	26.6	C+	32 ft
WB Approach								42.9	D+	
RT	12/1	0.295	0.433	546	686	289	0.421	22.5	C+	268 ft
TH	12/1	0.476	0.433	684	807	772	0.957	50.5	*D	949 ft
LT	12/1	0.120	0.056	1	80	6	0.061	40.5	*D+	7 ft
EB Approach								38.6	D+	
RT	12/1	0.132	0.522	712	827	17	0.021	13.2	B+	15 ft
TH	24/2	0.157	0.522	1729	1848	250	0.135	14.1	B+	105 ft
LT	12/1	0.214	0.144	74	243	228	0.891	67.4	*E+	310 ft

Institute for Astronomy
AM Peak Hour of Traffic
Year 2005 with Phase 1

12/23/03
13:59:18

SIGNAL2000/TEAPAC[Ver 1.11.00] - Summary of Parameter Values

Intersection Parameters for Int # 0 - Haleakala Highway/Makawao Aven

METROAREA	NONCBD			
SIMULATION PERIOD	15			
LEVELOFSERVICE	C	S		
NODELOCATION	0	0		
QUEUEMODELS	1	90	25	40

Approach Parameters

APPLABELS	SB	WB	NB	EB
GRADES	0.0	0.0	0.0	0.0
PEDLEVELS	0	0	0	0
BIKEVOLUMES	0	0	0	0
PARKINGSIDES	NONE	NONE	NONE	NONE
PARKVOLUMES	20	20	20	20
BUSVOLUMES	0	0	0	0
RIGHTTURNONREDS	0	0	0	0
UPSTREAMVC	0.00	0.00	0.00	0.00

Movement Parameters

MOVLABELS	RT	TH	LT	RT	TH	LT	RT	TH	LT	RT	TH	LT
VOLUMES	275	260	270	260	695	5	10	100	30	15	225	205
WIDTHS	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	24.0	12.0
LANES	1	1	1	1	1	1	1	1	1	1	2	1
GROUPTYPES	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM
UTILIZATIONS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRUCKPERCENTS	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
PEAKHOURFACTORS	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
ARRIVALTYPES	3	3	3	2	2	2	3	3	3	2	2	2
ACTUATIONS	NO	YES	YES	NO	YES	YES	NO	YES	YES	NO	YES	YES
REQCLEARANCES	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
MINIMUMS	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
STARTUPLOST	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
ENDGAIN	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
STORAGE	0	0	0	0	0	0	0	0	0	0	0	0
INITIALQUEUE	0	0	0	0	0	0	0	0	0	0	0	0
IDEALSATFLOWS	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
FACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
DELAYFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
NSTOPFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
SATURATIONFLOWS	1583	1863	1277	1583	1863	1770	1583	1863	717	1583	3539	1770

Phasing Parameters

SEQUENCES	16	16		
PERMISSIVES	NO	NO	NO	NO
OVERLAPS	YES	YES	YES	YES
CYCLES	90	180	10	
GREENTIMES	23.00	5.00	3.00	39.00
YELLOWTIMES	5.00	5.00	5.00	5.00
CRITICALS	3	6	12	5
EXCESS	0			

LEADLAGS	NONE	NONE
OFFSET	0.00	1
PEDTIME	0.0	0

Institute for Astronomy
PM Peak Hour of Traffic
Year 2005 with Phase 1

12/26/03
08:52:52

SIGNAL2000/TEAPAC[Ver 1.11.00] - Capacity Analysis Summary

Intersection Averages for Int # 0 - Haleakala Highway/Makawao Aven
Degree of Saturation (v/c) 0.62 Vehicle Delay 28.6 Level of Service C

```
        ------------------------------------------
Sq 16  |  Phase 1  |  Phase 2  |  Phase 3  |  Phase 4  |
**/**   ------------------------------------------
       | + + *     | +         | +         |       ^   |
   .   | + + *     | +         | +         |      ++++|
 /|\   |<+ + *>    |<+         |<+         |     <****|
  |    |   v       |    ^  ++++|   ^       |          |
  |    |       ^   |****   v   |++++       |          |
North  |    <+ + +>|         +>|++++>      |++++>     |
  |    |     + + + |         + |++++       |++++      |
       |     + + + |         + |   v       |   v      |
        ------------------------------------------
       | G/C=0.317 | G/C=0.067 | G/C=0.017 | G/C=0.267 |
       | G=  19.0" | G=   4.0" | G=   1.0" | G=  16.0" |
       | Y+R= 5.0" | Y+R= 5.0" | Y+R= 5.0" | Y+R= 5.0" |
       | OFF= 0.0% | OFF=40.0% | OFF=55.0% | OFF=65.0% |
        ------------------------------------------
       C= 60 sec   G= 40.0 sec = 66.7%  Y=20.0 sec = 33.3%  Ped= 0.0 sec =  0.0%
```

Lane Group	Width/ Lanes	g/C Reqd	g/C Used	Service Rate @C (vph)	Service Rate @E	Adj Volume	v/c	HCM Delay	L S	Queue Model 1
SB Approach								22.8	C+	
RT	12/1	0.171	0.567	866	897	178	0.198	6.8	A	77 ft
TH	12/1	0.221	0.317	525	590	339	0.575	18.5	B	227 ft
LT	12/1	0.351	0.317	132	171	150	0.857	51.2	*D	142 ft
NB Approach								21.7	C+	
RT	12/1	0.046	0.467	688	739	17	0.023	8.7	A	8 ft
TH	12/1	0.270	0.317	525	590	433	0.734	23.0	C+	316 ft
LT	12/1	0.000	0.317	200	250	50	0.200	15.4	B	30 ft
WB Approach								41.9	D+	
RT	12/1	0.206	0.267	332	422	233	0.552	24.9	C+	179 ft
TH	12/1	0.293	0.267	423	497	472	0.950	50.6	*D	456 ft
LT	12/1	0.018	0.067	70	106	11	0.093	26.6	C+	9 ft
EB Approach								25.6	C+	
RT	12/1	0.081	0.367	501	581	50	0.086	14.1	B+	34 ft
TH	24/2	0.136	0.367	1232	1298	389	0.300	15.1	B	131 ft
LT	12/1	0.181	0.167	225	295	250	0.847	44.3	*D+	228 ft

Institute for Astronomy
PM Peak Hour of Traffic
Year 2005 with Phase 1

12/26/03
08:52:57

SIGNAL2000/TEAPAC[Ver 1.11.00] - Summary of Parameter Values

Intersection Parameters for Int # 0 - Haleakala Highway/Makawao Aven

METROAREA	NONCBD			
SIMULATION PERIOD	15			
LEVELOFSERVICE	C	S		
NODELOCATION	0	0		
QUEUEMODELS	1	90	25	40

Approach Parameters

APPLABELS	SB	WB	NB	EB
GRADES	0.0	0.0	0.0	0.0
PEDLEVELS	0	0	0	0
BIKEVOLUMES	0	0	0	0
PARKINGSIDES	NONE	NONE	NONE	NONE
PARKVOLUMES	20	20	20	20
BUSVOLUMES	0	0	0	0
RIGHTTURNONREDS	0	0	0	0
UPSTREAMVC	0.00	0.00	0.00	0.00

Movement Parameters

MOVLABELS	RT	TH	LT	RT	TH	LT	RT	TH	LT	RT	TH	LT
VOLUMES	160	305	135	210	425	10	15	390	45	45	350	225
WIDTHS	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	24.0	12.0
LANES	1	1	1	1	1	1	1	1	1	1	2	1
GROUPTYPES	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM
UTILIZATIONS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRUCKPERCENTS	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
PEAKHOURFACTORS	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
ARRIVALTYPES	3	3	3	2	2	2	3	3	3	2	2	2
ACTUATIONS	NO	YES	YES	NO	YES	YES	NO	YES	YES	NO	YES	YES
REQCLEARANCES	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
MINIMUMS	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
STARTUPLOST	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
ENDGAIN	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
STORAGE	0	0	0	0	0	0	0	0	0	0	0	0
INITIALQUEUE	0	0	0	0	0	0	0	0	0	0	0	0
IDEALSATFLOWS	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
FACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
DELAYFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
NSTOPFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
SATURATIONFLOWS	1583	1863	551	1583	1863	1770	1583	1863	791	1583	3539	1770

Phasing Parameters

SEQUENCES	16	16		
PERMISSIVES	NO	NO	NO	NO
OVERLAPS	YES	YES	YES	YES
CYCLES	60	180	10	
GREENTIMES	19.00	4.00	1.00	16.00
YELLOWTIMES	5.00	5.00	5.00	5.00
CRITICALS	3	12	0	5
EXCESS	0			

LEADLAGS	NONE	NONE
OFFSET	0.00	1
PEDTIME	0.0	0

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Institute for Astronomy                                          12/26/03
AM Peak Hour of Traffic                                          08:54:02
Year 2005 with Phase 1

SIGNAL2000/TEAPAC[Ver 1.11.00] - Capacity Analysis Summary

Intersection Averages for Int #   0 - Kula Highway/Haleakala Highway
      Degree of Saturation (v/c) 0.79  Vehicle Delay  39.9  Level of Service D+

        ---------------------------------------------------
Sq 61  |  Phase 1  |  Phase 2  |  Phase 3  |  Phase 4  |
**/**  ---------------------------------------------------
       |     *     |           | + +       |           |
   .   |     *     |           | + +       |           |
 /|\   |     *>    |           |<+ +       |     <****|
  |    |           |           |    v      |   ^  ****|
  |    |           |        ^  |        ^  |++++   v  |
North  |    <+     |     <* +  |        *  |++++>     |
  |    |     +     |      * +  |        *  |          |
       |     +     |      * +  |        *  |          |
        ---------------------------------------------------
       | G/C=0.078 | G/C=0.067 | G/C=0.378 | G/C=0.256 |
       | G=   7.0" | G=   6.0" | G=  34.0" | G=  23.0" |
       | Y+R= 5.0" | Y+R= 5.0" | Y+R= 5.0" | Y+R= 5.0" |
       | OFF= 0.0% | OFF=13.3% | OFF=25.6% | OFF=68.9% |
        ---------------------------------------------------
       C= 90 sec    G= 70.0 sec = 77.8%  Y=20.0 sec = 22.2%  Ped= 0.0 sec =  0.0%

-----------------------------------------------------------------------------
| Lane    |Width/|      g/C      | Service Rate|  Adj  |       |  HCM  | L | Queue |
|  Group  | Lanes| Reqd    Used  | @C (vph) @E |Volume|  v/c  | Delay | S |Model 1|
-----------------------------------------------------------------------------

SB Approach                                                      33.1   C
=============================================================================
|  RT    | 12/1 |0.123 |0.378 |  442 |  598 |     6 |0.010 |  19.6 | B |    6 ft|
|  TH    | 12/1 |0.339 |0.378 |  569 |  704 |   489 |0.695 |  29.4 | C |  503 ft|
|  LT    | 12/1 |0.152 |0.078 |    1 |  119 |    94 |0.681 |  53.3 |*D |  121 ft|
-----------------------------------------------------------------------------

NB Approach                                                      44.5   D+
=============================================================================
|  TH    | 12/1 |0.524 |0.500 |  823 |  931 |   872 |0.937 |  42.6 |*D+|1017 ft|
|  LT    | 12/1 |0.251 |0.200 |  203 |  349 |   294 |0.831 |  50.1 |*D |  364 ft|
-----------------------------------------------------------------------------

WB Approach                                                      42.2   D+
=============================================================================
|  TH+LT| 12/1 |0.282 |0.256 |  214 |  320 |   250 |0.774 |  42.2 |*D+|  293 ft|
-----------------------------------------------------------------------------

EB Approach                                                      27.9   C
=============================================================================
|  TH+LT| 12/1 |0.176 |0.256 |  330 |  470 |   167 |0.355 |  27.9 | C |  160 ft|
-----------------------------------------------------------------------------
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Institute for Astronomy                                                12/26/03
AM Peak Hour of Traffic                                                08:54:07
Year 2005 with Phase 1

SIGNAL2000/TEAPAC[Ver 1.11.00] - Summary of Parameter Values

   Intersection Parameters for Int #   0 - Kula Highway/Haleakala Highway
METROAREA            NONCBD
SIMULATION PERIOD        15
LEVELOFSERVICE      C     S
NODELOCATION        0     0
QUEUEMODELS     1  90  25  40

   Approach Parameters
APPLABELS               SB                WB                NB                EB
GRADES                 0.0               0.0               0.0               0.0
PEDLEVELS                0                 0                 0                 0
BIKEVOLUMES              0                 0                 0                 0
PARKINGSIDES          NONE              NONE              NONE              NONE
PARKVOLUMES             20                20                20                20
BUSVOLUMES               0                 0                 0                 0
RIGHTTURNONREDS          0                 0                 0                 0
UPSTREAMVC            0.00              0.00              0.00              0.00

   Movement Parameters
MOVLABELS          RT   TH   LT     RT   TH   LT     RT   TH   LT     RT   TH   LT
VOLUMES             5  440   85    165  100  125    140  785  265    455  145    5
WIDTHS           12.0 12.0 12.0   12.0 12.0  0.0   12.0 12.0 12.0   12.0 12.0  0.0
LANES               1    1    1      1    1    0      1    1    1      1    1    0
GROUPTYPES       NORM NORM NORM   FFLW NORM NORM   FFLW NORM NORM   FFLW NORM NORM
UTILIZATIONS     0.00 0.00 0.00   0.00 0.00 0.00   0.00 0.00 0.00   0.00 0.00 0.00
TRUCKPERCENTS     2.0  2.0  2.0    2.0  2.0  2.0    2.0  2.0  2.0    2.0  2.0  2.0
PEAKHOURFACTORS  0.90 0.90 0.90   0.90 0.90 0.90   0.90 0.90 0.90   0.90 0.90 0.90
ARRIVALTYPES        2    2    2      3    3    3      2    2    2      3    3    3
ACTUATIONS         NO  YES  YES     NO  YES  YES     NO  YES  YES     NO  YES  YES
REQCLEARANCES     5.0  5.0  5.0    5.0  5.0  5.0    5.0  5.0  5.0    5.0  5.0  5.0
MINIMUMS          5.0  5.0  5.0    5.0  5.0  5.0    5.0  5.0  5.0    5.0  5.0  5.0
STARTUPLOST       2.0  2.0  2.0    2.0  2.0  2.0    2.0  2.0  2.0    2.0  2.0  2.0
ENDGAIN           2.0  2.0  2.0    2.0  2.0  2.0    2.0  2.0  2.0    2.0  2.0  2.0
STORAGE             0    0    0      0    0    0      0    0    0      0    0    0
INITIALQUEUE        0    0    0      0    0    0      0    0    0      0    0    0
IDEALSATFLOWS    1900 1900 1900   1900 1900 1900   1900 1900 1900   1900 1900 1900
FACTORS          1.00 1.00 1.00   1.00 1.00 1.00   1.00 1.00 1.00   1.00 1.00 1.00
DELAYFACTORS     1.00 1.00 1.00   1.00 1.00 1.00   1.00 1.00 1.00   1.00 1.00 1.00
NSTOPFACTORS     1.00 1.00 1.00   1.00 1.00 1.00   1.00 1.00 1.00   1.00 1.00 1.00
SATURATIONFLOWS  1583 1863 1770      0 1265    0      0 1863 1770      0 1840    0

   Phasing Parameters
SEQUENCES          61    61
PERMISSIVES        NO    NO    NO    NO          LEADLAGS        NONE   NONE
OVERLAPS          YES   YES   YES   YES          OFFSET          0.00      1
CYCLES             90   180    10                PEDTIME          0.0      0
GREENTIMES       7.00  6.00 34.00 23.00
YELLOWTIMES      5.00  5.00  5.00  5.00
CRITICALS           3     9     8     5
EXCESS              0
```

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Institute for Astronomy                                             12/26/03
PM Peak Hour of Traffic                                             08:54:35
Year 2005 with Phase 1

SIGNAL2000/TEAPAC[Ver 1.11.00] - Capacity Analysis Summary

Intersection Averages for Int #   0 - Kula Highway/Haleakala Highway
    Degree of Saturation (v/c) 0.68  Vehicle Delay  22.2  Level of Service C+

       --------------------------------------------------
Sq 61 |  Phase 1  |  Phase 2  |  Phase 3  |  Phase 4  |
**/** --------------------------------------------------
      |     *     |           | + *       |           |
  .   |     *     |           | + *       |           |
 /|\  |     *>    |           |<+ *       |     <****|
  |   |           |           |   v       |  ^   ****|
  |   |           |      ^    |       ^   |++++   v  |
North |    <+     |    <* +   |       +   |++++>     |
  |   |     +     |     * +   |       +   |          |
      |     +     |     * +   |       +   |          |
       --------------------------------------------------
      | G/C=0.100 | G/C=0.050 | G/C=0.367 | G/C=0.150 |
      | G=   6.0" | G=   3.0" | G=  22.0" | G=   9.0" |
      | Y+R= 5.0" | Y+R= 5.0" | Y+R= 5.0" | Y+R= 5.0" |
      | OFF= 0.0% | OFF=18.3% | OFF=31.7% | OFF=76.7% |
       --------------------------------------------------
      C= 60 sec   G= 40.0 sec = 66.7%  Y=20.0 sec = 33.3%  Ped= 0.0 sec =  0.0%

-------------------------------------------------------------------------------
| Lane   |Width/|     g/C     | Service Rate|  Adj |       |  HCM  | L | Queue |
|  Group | Lanes| Reqd   Used | @C (vph) @E |Volume|  v/c  | Delay | S |Model 1|
-------------------------------------------------------------------------------
SB Approach                                                23.2   C+
===============================================================================
|   RT   | 12/1 |0.027 |0.367 |  501 |  581 |    6 |0.010 |  13.4 | B+|   4 ft|
|   TH   | 12/1 |0.313 |0.367 |  616 |  683 |  511 |0.748 |  23.0 |*C+| 380 ft|
|   LT   | 12/1 |0.056 |0.100 |  118 |  169 |   56 |0.316 |  26.1 |*C+|  44 ft|
-------------------------------------------------------------------------------
NB Approach                                                20.9   C+
===============================================================================
|   TH   | 12/1 |0.376 |0.500 |  879 |  931 |  633 |0.680 |  16.1 | B | 422 ft|
|   LT   | 12/1 |0.220 |0.233 |  340 |  413 |  317 |0.768 |  30.5 |*C | 259 ft|
-------------------------------------------------------------------------------
WB Approach                                                27.4   C+
===============================================================================
|  TH+LT| 12/1 |0.126 |0.150 |  160 |  218 |  128 |0.577 |  27.4 |*C+| 101 ft|
-------------------------------------------------------------------------------
EB Approach                                                23.2   C+
===============================================================================
|  TH+LT| 12/1 |0.071 |0.150 |  202 |  271 |   78 |0.288 |  23.2 | C+|  56 ft|
-------------------------------------------------------------------------------
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Institute for Astronomy                                                 12/26/03
PM Peak Hour of Traffic                                                 08:54:42
Year 2005 with Phase 1

SIGNAL2000/TEAPAC[Ver 1.11.00] - Summary of Parameter Values

  Intersection Parameters for Int #   0 - Kula Highway/Haleakala Highway
METROAREA           NONCBD
SIMULATION PERIOD       15
LEVELOFSERVICE       C   S
NODELOCATION         0   0
QUEUEMODELS     1  90  25  40

  Approach Parameters
APPLABELS              SB              WB              NB              EB
GRADES                0.0             0.0             0.0             0.0
PEDLEVELS               0               0               0               0
BIKEVOLUMES             0               0               0               0
PARKINGSIDES         NONE            NONE            NONE            NONE
PARKVOLUMES            20              20              20              20
BUSVOLUMES              0               0               0               0
RIGHTTURNONREDS         0               0               0               0
UPSTREAMVC           0.00            0.00            0.00            0.00

  Movement Parameters
MOVLABELS          RT   TH   LT    RT   TH   LT    RT   TH   LT    RT   TH   LT
VOLUMES             5  460   50    80   55   60    45  570  285   275   65    5
WIDTHS           12.0 12.0 12.0  12.0 12.0  0.0  12.0 12.0 12.0  12.0 12.0  0.0
LANES               1    1    1     1    1    0     1    1    1     1    1    0
GROUPTYPES       NORM NORM NORM  FFLW NORM NORM  FFLW NORM NORM  FFLW NORM NORM
UTILIZATIONS     0.00 0.00 0.00  0.00 0.00 0.00  0.00 0.00 0.00  0.00 0.00 0.00
TRUCKPERCENTS     2.0  2.0  2.0   2.0  2.0  2.0   2.0  2.0  2.0   2.0  2.0  2.0
PEAKHOURFACTORS  0.90 0.90 0.90  0.90 0.90 0.90  0.90 0.90 0.90  0.90 0.90 0.90
ARRIVALTYPES        2    2    2     3    3    3     2    2    2     3    3    3
ACTUATIONS         NO  YES  YES    NO  YES  YES    NO  YES  YES    NO  YES  YES
REQCLEARANCES     5.0  5.0  5.0   5.0  5.0  5.0   5.0  5.0  5.0   5.0  5.0  5.0
MINIMUMS          5.0  5.0  5.0   5.0  5.0  5.0   5.0  5.0  5.0   5.0  5.0  5.0
STARTUPLOST       2.0  2.0  2.0   2.0  2.0  2.0   2.0  2.0  2.0   2.0  2.0  2.0
ENDGAIN           2.0  2.0  2.0   2.0  2.0  2.0   2.0  2.0  2.0   2.0  2.0  2.0
STORAGE             0    0    0     0    0    0     0    0    0     0    0    0
INITIALQUEUE        0    0    0     0    0    0     0    0    0     0    0    0
IDEALSATFLOWS    1900 1900 1900  1900 1900 1900  1900 1900 1900  1900 1900 1900
FACTORS          1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00
DELAYFACTORS     1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00
NSTOPFACTORS     1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00
SATURATIONFLOWS  1583 1863 1770     0 1483    0     0 1863 1770     0 1805    0

  Phasing Parameters
SEQUENCES          61     61
PERMISSIVES        NO     NO     NO     NO        LEADLAGS      NONE   NONE
OVERLAPS          YES    YES    YES    YES        OFFSET        0.00      1
CYCLES             60    180     10               PEDTIME        0.0      0
GREENTIMES       6.00   3.00  22.00   9.00
YELLOWTIMES      5.00   5.00   5.00   5.00
CRITICALS           3      9      2      5
EXCESS              0
```

Institute for Astronomy
AM Peak Hour of Traffic
Year 2005 with Phase 1

12/23/03
14:29:12

SIGNAL2000/TEAPAC[Ver 1.11.00] - Capacity Analysis Summary

Intersection Averages for Int # 0 - Old Haleakala Hwy/Pukalani St
Degree of Saturation (v/c) 0.53 Vehicle Delay 14.5 Level of Service B+

```
        --------------------------------------
Sq  0 | Phase 1  | Phase 2  | Phase 3  |
**/** --------------------------------------
      |          |          |          |
  .   |          |          |          |
 /|\  |          |     <++++|     <++++|
  |   |          |      ****|      ++++|
  |   |          |     v    |     v    |
North |   <+   *>|        +>|++++>     |
  |   |++++ +  * |        + |++++      |
      |  v +   * |        + |  v       |
        --------------------------------------
      | G/C=0.467 | G/C=0.083 | G/C=0.283 |
      | G=  28.0" | G=   5.0" | G=  17.0" |
      | Y+R= 5.0" | Y+R= 5.0" | Y+R= 0.0" |
      | OFF= 0.0% | OFF=55.0% | OFF=71.7% |
        --------------------------------------
      C= 60 sec   G= 50.0 sec = 83.3%  Y=10.0 sec = 16.7%  Ped= 0.0 sec =  0.0%
```

Lane Group	Width/ Lanes	g/C Reqd	g/C Used	Service Rate @C (vph)	Service Rate @E	Adj Volume	v/c	HCM Delay	L S	Queue Model 1
NB Approach								13.8	B+	
RT	12/1	0.228	0.633	985	1003	272	0.271	5.5	*A	107 ft
LT	12/1	0.386	0.467	783	826	628	0.760	17.4	B	419 ft
WB Approach								19.4	B	
TH	12/1	0.170	0.367	625	683	244	0.357	14.2	B+	141 ft
LT	12/1	0.052	0.083	397	452	339	0.750	23.2	*C+	253 ft
EB Approach								7.9	A	
RT	12/1	0.212	0.750	1188	1188	244	0.205	2.6	A	69 ft
TH	12/1	0.084	0.200	301	373	100	0.268	20.7	C+	68 ft

Institute for Astronomy
AM Peak Hour of Traffic
Year 2005 with Phase 1

12/23/03
14:29:21

SIGNAL2000/TEAPAC[Ver 1.11.00] - Summary of Parameter Values

Intersection Parameters for Int # 0 - Old Haleakala Hwy/Pukalani St

METROAREA	NONCBD			
SIMULATION PERIOD	15			
LEVELOFSERVICE	C	S		
NODELOCATION	0	0		
QUEUEMODELS	1	90	25	40

Approach Parameters

APPLABELS	SB	WB	NB	EB
GRADES	0.0	0.0	0.0	0.0
PEDLEVELS	0	0	0	0
BIKEVOLUMES	0	0	0	0
PARKINGSIDES	NONE	NONE	NONE	NONE
PARKVOLUMES	20	20	20	20
BUSVOLUMES	0	0	0	0
RIGHTTURNONREDS	0	0	0	0
UPSTREAMVC	0.00	0.00	0.00	0.00

Movement Parameters

MOVLABELS	RT	TH	LT	RT	TH	LT	RT	TH	LT	RT	TH	LT
VOLUMES	0	0	0	0	220	305	245	0	565	220	90	0
WIDTHS	0.0	0.0	0.0	0.0	12.0	12.0	12.0	0.0	12.0	12.0	12.0	0.0
LANES	0	0	0	0	1	1	1	0	1	1	1	0
GROUPTYPES	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM
UTILIZATIONS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRUCKPERCENTS	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
PEAKHOURFACTORS	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
ARRIVALTYPES	3	3	3	3	3	3	3	3	3	3	3	3
ACTUATIONS	NO	YES	YES	NO	YES	YES	NO	YES	YES	NO	YES	YES
REQCLEARANCES	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
MINIMUMS	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
STARTUPLOST	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
ENDGAIN	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
STORAGE	0	0	0	0	0	0	0	0	0	0	0	0
INITIALQUEUE	0	0	0	0	0	0	0	0	0	0	0	0
IDEALSATFLOWS	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
FACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
DELAYFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
NSTOPFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
SATURATIONFLOWS	0	0	0	0	1863	1770	1583	0	1770	1583	1863	0

Institute for Astronomy
AM Peak Hour of Traffic
Year 2005 with Phase 1

12/23/03
14:29:21

SIGNAL2000/TEAPAC[Ver 1.11.00] - Summary of Parameter Values

Phasing Parameters

SEQUENCES	0	0					
PERMISSIVES	YES	YES	YES	YES			
OVERLAPS	YES	YES	YES	YES			
CYCLES	60	120	10				
GREENTIMES	28.00	5.00	17.00				
YELLOWTIMES	5.00	5.00	0.00				
CRITICALS	7	6	2				
EXCESS	0						
PHASEMOVEMENTS	1	7	9	10	0	0	0
PHASEMOVEMENTS	2	6	7	5	0	0	0
PHASEMOVEMENTS	3	5	10	11	-6	0	0
PHASEMOVEMENTS	4	0	0	0	0	0	0
PHASEMOVEMENTS	5	0	0	0	0	0	0
PHASEMOVEMENTS	6	0	0	0	0	0	0

LEADLAGS	NONE	NONE
OFFSET	0.00	1
PEDTIME	0.0	0

Institute for Astronomy
PM Peak Hour of Traffic
Year 2005 with Phase 1

12/23/03
14:30:15

SIGNAL2000/TEAPAC[Ver 1.11.00] - Capacity Analysis Summary

Intersection Averages for Int # 0 - Old Haleakala Hwy/Pukalani St
Degree of Saturation (v/c) 0.50 Vehicle Delay 11.8 Level of Service B+

```
        --------------------------------------
Sq  0 |  Phase 1  |  Phase 2  |  Phase 3  |
**/** --------------------------------------
      |           |           |           |
 /|\  |           |      <++++|      <++++|
  |   |           |       ****|       ++++|
  |   |           |      v    |      v    |
North |    <+   *>|         +>|++++>      |
  |   |++++ +   * |         + |++++       |
      |   v +   * |         + |  v        |
      --------------------------------------
      | G/C=0.300 | G/C=0.083 | G/C=0.450 |
      | G= 18.0"  | G=  5.0"  | G= 27.0"  |
      | Y+R= 5.0" | Y+R= 5.0" | Y+R= 0.0" |
      | OFF= 0.0% | OFF=38.3% | OFF=55.0% |
      --------------------------------------
```

C= 60 sec G= 50.0 sec = 83.3% Y=10.0 sec = 16.7% Ped= 0.0 sec = 0.0%

Lane Group	Width/ Lanes	g/C Reqd	g/C Used	Service Rate @C (vph)	Service Rate @E	Adj Volume	v/c	HCM Delay	L S	Queue Model 1
NB Approach								16.4	B	
RT	12/1	0.300	0.467	688	739	394	0.533	14.1	*B+	230 ft
LT	12/1	0.213	0.300	465	531	306	0.576	19.3	B	209 ft
WB Approach								12.4	B+	
TH	12/1	0.116	0.533	963	993	150	0.151	7.2	A	61 ft
LT	12/1	0.018	0.083	528	568	400	0.704	14.4	*B+	252 ft
EB Approach								6.9	A	
RT	12/1	0.367	0.750	1188	1188	511	0.430	3.9	A	169 ft
TH	12/1	0.154	0.367	625	683	217	0.318	13.9	B+	123 ft

Institute for Astronomy
PM Peak Hour of Traffic
Year 2005 with Phase 1

12/23/03
14:30:21

SIGNAL2000/TEAPAC[Ver 1.11.00] - Summary of Parameter Values

Intersection Parameters for Int # 0 - Old Haleakala Hwy/Pukalani St

METROAREA		NONCBD		
SIMULATION PERIOD			15	
LEVELOFSERVICE		C	S	
NODELOCATION		0	0	
QUEUEMODELS	1	90	25	40

Approach Parameters

APPLABELS	SB	WB	NB	EB
GRADES	0.0	0.0	0.0	0.0
PEDLEVELS	0	0	0	0
BIKEVOLUMES	0	0	0	0
PARKINGSIDES	NONE	NONE	NONE	NONE
PARKVOLUMES	20	20	20	20
BUSVOLUMES	0	0	0	0
RIGHTTURNONREDS	0	0	0	0
UPSTREAMVC	0.00	0.00	0.00	0.00

Movement Parameters

MOVLABELS	RT	TH	LT	RT	TH	LT	RT	TH	LT	RT	TH	LT
VOLUMES	0	0	0	0	135	360	355	0	275	460	195	0
WIDTHS	0.0	0.0	0.0	0.0	12.0	12.0	12.0	0.0	12.0	12.0	12.0	0.0
LANES	0	0	0	0	1	1	1	0	1	1	1	0
GROUPTYPES	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM
UTILIZATIONS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRUCKPERCENTS	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
PEAKHOURFACTORS	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
ARRIVALTYPES	3	3	3	3	3	3	3	3	3	3	3	3
ACTUATIONS	NO	YES	YES	NO	YES	YES	NO	YES	YES	NO	YES	YES
REQCLEARANCES	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
MINIMUMS	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
STARTUPLOST	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
ENDGAIN	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
STORAGE	0	0	0	0	0	0	0	0	0	0	0	0
INITIALQUEUE	0	0	0	0	0	0	0	0	0	0	0	0
IDEALSATFLOWS	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
FACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
DELAYFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
NSTOPFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
SATURATIONFLOWS	0	0	0	0	1863	1770	1583	0	1770	1583	1863	0

Institute for Astronomy
PM Peak Hour of Traffic
Year 2005 with Phase 1

12/23/03
14:30:21

SIGNAL2000/TEAPAC[Ver 1.11.00] - Summary of Parameter Values

Phasing Parameters

SEQUENCES	0	0					
PERMISSIVES	YES	YES	YES	YES			
OVERLAPS	YES	YES	YES	YES			
CYCLES	60	120	10				
GREENTIMES	18.00	5.00	27.00				
YELLOWTIMES	5.00	5.00	0.00				
CRITICALS	7	6	2				
EXCESS	0						
PHASEMOVEMENTS	1	7	9	10	0	0	0
PHASEMOVEMENTS	2	6	7	5	0	0	0
PHASEMOVEMENTS	3	5	10	11	-6	0	0
PHASEMOVEMENTS	4	0	0	0	0	0	0
PHASEMOVEMENTS	5	0	0	0	0	0	0
PHASEMOVEMENTS	6	0	0	0	0	0	0

LEADLAGS	NONE	NONE
OFFSET	0.00	1
PEDTIME	0.0	0

Institute for Astronomy
AM Peak Hour of Traffic
Year 2005 with Phase 1

12/23/03
14:26:16

SIGNAL2000/TEAPAC[Ver 1.11.00] - Capacity Analysis Summary

Intersection Averages for Int #   0 - Old Haleakala Highway/Makawao
Degree of Saturation (v/c) 0.54 Vehicle Delay 16.3   Level of Service B

```
         ----------------------------------------
Sq  0 |  Phase 1   |  Phase 2  |  Phase 3   |
**/** ----------------------------------------
      | + * *      |           |        ^   |
      | + * *      |           |         ****|
 /|\  |<+ * *>     |           |       <****|
  |   |   v        |     ^     |    ^   ****|
  |   |        ^   |++++       |++++    v   |
North |   <+ + +>  |++++>      |++++>       |
  |   |     + + +  |++++       |++++        |
      |     + + +  |    v      |    v       |
      ----------------------------------------
      | G/C=0.300 | G/C=0.050 | G/C=0.400 |
      | G=  18.0" | G=   3.0" | G=  24.0" |
      | Y+R= 5.0" | Y+R= 5.0" | Y+R= 5.0" |
      | OFF= 0.0% | OFF=38.3% | OFF=51.7% |
      ----------------------------------------
      C= 60 sec   G= 45.0 sec = 75.0%  Y=15.0 sec = 25.0%  Ped= 0.0 sec =  0.0%
```

Lane Group	Width/ Lanes	g/C Reqd	g/C Used	Service Rate @C (vph)	Service Rate @E	Adj Volume	v/c	HCM Delay	L S	Queue Model 1
SB Approach								19.7	B	
RT	12/1	0.209	0.300	395	475	239	0.503	21.1	C+	166 ft
TH+LT	12/1	0.126	0.300	316	376	105	0.279	16.5	*B	65 ft
NB Approach								21.8	C+	
RT+TH+LT	12/1	0.242	0.300	426	491	327	0.666	21.8	C+	235 ft
WB Approach								18.0	B	
RT+TH+LT	12/1	0.315	0.400	598	652	450	0.690	18.0	*B	303 ft
EB Approach								8.6	A	
RT+TH	12/1	0.269	0.533	956	986	428	0.434	8.8	A	206 ft
LT	12/1	0.060	0.533	913	944	61	0.065	6.8	A	24 ft

Institute for Astronomy
AM Peak Hour of Traffic
Year 2005 with Phase 1

12/23/03
14:26:23

SIGNAL2000/TEAPAC[Ver 1.11.00] - Summary of Parameter Values

Intersection Parameters for Int #   0 - Old Haleakala Highway/Makawao

METROAREA	NONCBD			
SIMULATION PERIOD	15			
LEVELOFSERVICE	C	S		
NODELOCATION	0	0		
QUEUEMODELS	1	90	25	40

Approach Parameters

APPLABELS	SB	WB	NB	EB
GRADES	0.0	0.0	0.0	0.0
PEDLEVELS	0	0	0	0
BIKEVOLUMES	0	0	0	0
PARKINGSIDES	NONE	NONE	NONE	NONE
PARKVOLUMES	20	20	20	20
BUSVOLUMES	0	0	0	0
RIGHTTURNONREDS	0	0	0	0
UPSTREAMVC	0.00	0.00	0.00	0.00

Movement Parameters

MOVLABELS	RT	TH	LT	RT	TH	LT	RT	TH	LT	RT	TH	LT
VOLUMES	215	40	55	65	285	55	190	75	30	20	365	55
WIDTHS	12.0	12.0	0.0	0.0	12.0	0.0	0.0	12.0	0.0	0.0	12.0	12.0
LANES	1	1	0	0	1	0	0	1	0	0	1	1
GROUPTYPES	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM
UTILIZATIONS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRUCKPERCENTS	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
PEAKHOURFACTORS	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
ARRIVALTYPES	3	3	3	3	3	3	3	3	3	3	3	3
ACTUATIONS	NO	YES	YES	NO	YES	YES	NO	YES	YES	NO	YES	YES
REQCLEARANCES	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
MINIMUMS	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
STARTUPLOST	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
ENDGAIN	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
STORAGE	0	0	0	0	0	0	0	0	0	0	0	0
INITIALQUEUE	0	0	0	0	0	0	0	0	0	0	0	0
IDEALSATFLOWS	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
FACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
DELAYFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
NSTOPFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
SATURATIONFLOWS	1583	1254	0	0	1630	0	0	1637	0	0	1848	1770

Institute for Astronomy
AM Peak Hour of Traffic
Year 2005 with Phase 1

12/23/03
14:26:23

SIGNAL2000/TEAPAC[Ver 1.11.00] - Summary of Parameter Values

Phasing Parameters							
SEQUENCES	0	0					
PERMISSIVES	NO	NO	NO	NO			
OVERLAPS	YES	YES	YES	YES			
CYCLES	60	120	10				
GREENTIMES	18.00	3.00	24.00				
YELLOWTIMES	5.00	5.00	5.00				
CRITICALS	2	6	5				
EXCESS	0						
PHASEMOVEMENTS	1	1	2	3	7	8	9
PHASEMOVEMENTS	2	10	11	12	0	0	0
PHASEMOVEMENTS	3	4	5	6	10	11	12
PHASEMOVEMENTS	4	0	0	0	0	0	0
PHASEMOVEMENTS	5	0	0	0	0	0	0
PHASEMOVEMENTS	6	0	0	0	0	0	0

LEADLAGS	NONE	NONE
OFFSET	0.00	1
PEDTIME	0.0	0

Institute for Astronomy
PM Peak Hour of Traffic
Year 2005 with Phase 1

12/23/03
14:27:58

SIGNAL2000/TEAPAC[Ver 1.11.00] - Capacity Analysis Summary

Intersection Averages for Int # 0 - Old Haleakala Highway/Makawao
Degree of Saturation (v/c) 0.45 Vehicle Delay 14.2 Level of Service B+

```
        -------------------------------------------
Sq  0 |  Phase 1  |  Phase 2  |  Phase 3  |
**/** -------------------------------------------
      | + * *     |           |        ^  |
      | + * *     |           |     ****|
 /|\  |<+ * *>    |           |    <****|
  |   |  v        |     ^     |  ^  ****|
  |   |       ^   |++++       |++++  v    |
North |   <+ + +>|++++>      |++++>      |
  |   |    + + + |++++       |++++       |
      |    + + + |   v       |   v       |
      -------------------------------------------
      | G/C=0.300 | G/C=0.050 | G/C=0.400 |
      | G= 18.0"  | G=  3.0"  | G= 24.0"  |
      | Y+R= 5.0" | Y+R= 5.0" | Y+R= 5.0" |
      | OFF= 0.0% | OFF=38.3% | OFF=51.7% |
      -------------------------------------------
  C= 60 sec   G= 45.0 sec = 75.0%  Y=15.0 sec = 25.0%  Ped= 0.0 sec =  0.0%
```

Lane Group	Width/ Lanes	g/C Reqd	g/C Used	Service Rate @C (vph)	Service Rate @E	Adj Volume	v/c	HCM Delay	L S	Queue Model 1
SB Approach								22.1	C+	
RT	12/1	0.245	0.300	395	475	300	0.632	24.4	C+	219 ft
TH+LT	12/1	0.120	0.300	389	452	122	0.270	16.3	+B	75 ft
NB Approach								16.1	B	
RT+TH+LT	12/1	0.108	0.300	441	506	122	0.241	16.1	B	74 ft
WB Approach								15.5	B	
RT+TH+LT	12/1	0.277	0.400	622	676	400	0.592	15.5	+B	251 ft
EB Approach								8.3	A	
RT+TH	12/1	0.227	0.533	949	979	344	0.351	8.3	A	157 ft
LT	12/1	0.234	0.533	913	944	344	0.364	8.3	A	159 ft

Institute for Astronomy
PM Peak Hour of Traffic
Year 2005 with Phase 1

12/23/03
14:28:07

SIGNAL2000/TEAPAC[Ver 1.11.00] - Summary of Parameter Values

Intersection Parameters for Int # 0 - Old Haleakala Highway/Makawao

METROAREA	NONCBD			
SIMULATION PERIOD	15			
LEVELOFSERVICE	C	S		
NODELOCATION	0	0		
QUEUEMODELS	1	90	25	40

Approach Parameters

APPLABELS	SB	WB	NB	EB
GRADES	0.0	0.0	0.0	0.0
PEDLEVELS	0	0	0	0
BIKEVOLUMES	0	0	0	0
PARKINGSIDES	NONE	NONE	NONE	NONE
PARKVOLUMES	20	20	20	20
BUSVOLUMES	0	0	0	0
RIGHTTURNONREDS	0	0	0	0
UPSTREAMVC	0.00	0.00	0.00	0.00

Movement Parameters

MOVLABELS	RT	TH	LT	RT	TH	LT	RT	TH	LT	RT	TH	LT
VOLUMES	270	55	55	70	250	40	30	60	20	30	280	310
WIDTHS	12.0	12.0	0.0	0.0	12.0	0.0	0.0	12.0	0.0	0.0	12.0	12.0
LANES	1	1	0	0	1	0	0	1	0	0	1	1
GROUPTYPES	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM
UTILIZATIONS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRUCKPERCENTS	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
PEAKHOURFACTORS	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
ARRIVALTYPES	3	3	3	3	3	3	3	3	3	3	3	3
ACTUATIONS	NO	YES	YES	NO	YES	YES	NO	YES	YES	NO	YES	YES
REQCLEARANCES	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
MINIMUMS	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
STARTUPLOST	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
ENDGAIN	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
STORAGE	0	0	0	0	0	0	0	0	0	0	0	0
INITIALQUEUE	0	0	0	0	0	0	0	0	0	0	0	0
IDEALSATFLOWS	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
FACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
DELAYFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
NSTOPFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
SATURATIONFLOWS	1583	1506	0	0	1689	0	0	1688	0	0	1836	1770

Institute for Astronomy
PM Peak Hour of Traffic
Year 2005 with Phase 1

12/23/03
14:28:07

SIGNAL2000/TEAPAC[Ver 1.11.00] - Summary of Parameter Values

Phasing Parameters

SEQUENCES	0	0								
PERMISSIVES	NO	NO	NO	NO				LEADLAGS	NONE	NONE
OVERLAPS	YES	YES	YES	YES				OFFSET	0.00	1
CYCLES	60	120	10					PEDTIME	0.0	0
GREENTIMES	18.00	3.00	24.00							
YELLOWTIMES	5.00	5.00	5.00							
CRITICALS	2	6	5							
EXCESS	0									
PHASEMOVEMENTS	1	1	2	3	7	8	9			
PHASEMOVEMENTS	2	10	11	12	0	0	0			
PHASEMOVEMENTS	3	4	5	6	10	11	12			
PHASEMOVEMENTS	4	0	0	0	0	0	0			
PHASEMOVEMENTS	5	0	0	0	0	0	0			
PHASEMOVEMENTS	6	0	0	0	0	0	0			

CHAPTER 17 - TWSC - UNSIGNALIZED INTERSECTIONS WORKSHEET

Analysis Summary

General Information		Site Information	
Analyst	TL	Jurisdiction/Date	KULA, MAUI 12/23/200
Agency or Company	ATA	Major Street	KULA HWY
Analysis Period/Year	AM PEAK HOUR 2005	Minor Street	KKHS DRWY
Comment	YEAR 2005 WITH PHASE 1		

Input Data

Lane Configuration	SB			NB			EB			WB		
Lane 1 (curb)	TR			R			LTR			R		
Lane 2	L			LT						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)	230	755	5	5	1050	130	5	0	5	20		125
PHF	.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
Flow rate	256	839	6	6	1167	144	6	0	6	22		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
EB	1	LTR	13	7	1.77	3	1317.2	F	1317.2
	2								
	3								F
WB	1	R	125	235	.532	3	36.5	E	202.8
	2	L	22	11	2.004	4	1147.7	F	
	3								F
		①	256	524	.487	3	18.2	C	
		④	6	788	.007	<1	9.6	A	

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1 of 1

CHAPTER 17 - TWSC - UNSIGNALIZED INTERSECTIONS WORKSHEET

Analysis Summary

General Information		Site Information	
Analyst	TL	Jurisdiction/Date	KULA, MAUI 12/23/200
Agency or Company	ATA	Major Street	KULA HWY
Analysis Period/Year	PM PEAK HOUR 2005	Minor Street	KKHS DRWY
Comment	YEAR 2005 WITH PHASE 1		

Input Data

Lane Configuration	SB			NB			EB			WB		
Lane 1 (curb)	TR			R			LTR			R		
Lane 2	L			LT						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)	20	785	5	5	860	5	5	0	5	10		30
PHF	.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
Flow rate	22	872	6	6	956	6	6	0	6	11		33
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
EB	1	LTR	13	78	.167	1	60.2	F	60.2
	2								
	3								F
WB	1	R	33	312	.106	<1	17.9	C	37.2
	2	L	11	51	.218	1	95.1	F	
	3								E
		①	22	712	.031	<1	10.2	B	
		④	6	765	.007	<1	9.7	A	

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1 of 1

Institute for Astronomy
Year 2005 with Phase 1
AM Peak Hour of Traffic

12/26/03
09:32:49

SIGNAL2000/TEAPAC[Ver 1.11.00] - Capacity Analysis Summary

Intersection Averages for Int # 0 - Kula Hwy/A'Apueo Pkwy
Degree of Saturation (v/c) 0.60 Vehicle Delay 17.8 Level of Service B

```
        --------------------------
Sq 11 |  Phase 1  |  Phase 2  |
**/** --------------------------
      | + +       | +         |
  .   | + +       | +         |
 /|\  |<+ +       |<+         |
  |   |   v       |    ^      |
  |   |        ^  |****       |
North |     <+ *  |           |
  |   |       + * |++++       |
      |       + * |    v      |
        --------------------------
      | G/C=0.600 | G/C=0.289 |
      | G=  54.0" | G=  26.0" |
      | Y+R= 5.0" | Y+R= 5.0" |
      | OFF= 0.0% | OFF=65.6% |
        --------------------------
      C= 90 sec   G= 80.0 sec = 88.9%  Y=10.0 sec = 11.1%  Ped= 0.0 sec =  0.0%
```

Lane Group	Width/ Lanes	g/C Reqd	g/C Used	Service Rate @C (vph)	Service Rate @E	Adj Volume	v/c	HCM Delay	L S	Queue Model 1
SB Approach								7.8	A	
RT	12/1	0.352	1.000	1583	1583	394	0.249	0.4	A	26 ft
TH	12/1	0.336	0.600	1032	1118	483	0.432	13.8	B+	389 ft
NB Approach								20.9	C+	
TH	12/1	0.551	0.600	1073	1118	967	0.865	22.2	*C+	924 ft
LT	12/1	0.255	0.600	369	417	106	0.254	8.8	A	62 ft
EB Approach								30.9	C	
RT	12/1	0.169	0.289	297	457	72	0.158	24.6	C+	69 ft
LT	12/1	0.273	0.289	382	511	350	0.685	32.2	*C	366 ft

Institute for Astronomy
Year 2005 with Phase 1
AM Peak Hour of Traffic

12/26/03
09:32:58

SIGNAL2000/TEAPAC[Ver 1.11.00] - Summary of Parameter Values

Intersection Parameters for Int # 0 - Kula Hwy/A'Apueo Pkwy

METROAREA	NONCBD			
SIMULATION PERIOD	15			
LEVELOFSERVICE	C	S		
NODELOCATION	0	0		
QUEUEMODELS	1	90	25	40

Approach Parameters

APPLABELS	SB	WB	NB	EB
GRADES	0.0	0.0	0.0	0.0
PEDLEVELS	0	0	0	0
BIKEVOLUMES	0	0	0	0
PARKINGSIDES	NONE	NONE	NONE	NONE
PARKVOLUMES	20	20	20	20
BUSVOLUMES	0	0	0	0
RIGHTTURNONREDS	0	0	0	0
UPSTREAMVC	0.00	0.00	0.00	0.00

Movement Parameters

MOVLABELS	RT	TH	LT	RT	TH	LT	RT	TH	LT	RT	TH	LT
VOLUMES	355	435	0	0	0	0	0	870	95	65	0	315
WIDTHS	12.0	12.0	0.0	0.0	0.0	0.0	0.0	12.0	12.0	12.0	0.0	12.0
LANES	1	1	0	0	0	0	0	1	1	1	0	1
GROUPTYPES	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM
UTILIZATIONS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRUCKPERCENTS	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
PEAKHOURFACTORS	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
ARRIVALTYPES	2	2	2	3	3	3	3	3	3	3	3	3
ACTUATIONS	NO	YES	YES	NO	YES	YES	NO	YES	YES	NO	YES	YES
REQCLEARANCES	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
MINIMUMS	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
STARTUPLOST	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
ENDGAIN	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
STORAGE	0	0	0	0	0	0	0	0	0	0	0	0
INITIALQUEUE	0	0	0	0	0	0	0	0	0	0	0	0
IDEALSATFLOWS	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
FACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
DELAYFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
NSTOPFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
SATURATIONFLOWS	1583	1863	0	0	0	0	0	1863	696	1583	0	1770

Phasing Parameters

SEQUENCES	11	11					
PERMISSIVES	NO	NO	NO	NO	LEADLAGS	NONE	NONE
OVERLAPS	YES	YES	YES	YES	OFFSET	0.00	1
CYCLES	90	180	90		PEDTIME	0.0	0
GREENTIMES	54.00	26.00					
YELLOWTIMES	5.00	5.00					
CRITICALS	8	12					
EXCESS	0						

Institute for Astronomy
Year 2005 with Phase 1
PM Peak Hour of Traffic

12/26/03
09:33:18

SIGNAL2000/TEAPAC[Ver 1.11.00] - Capacity Analysis Summary

Intersection Averages for Int # 0 - Kula Hwy/A'Apueo Pkwy
Degree of Saturation (v/c) 0.58 Vehicle Delay 13.6 Level of Service B+

```
         --------------------------
Sq 11  |  Phase 1  |  Phase 2  |
**/**  --------------------------
       | + *       | +         |
   .   | + *       | +         |
 /|\   |<+ *       |<+         |
  |    |   v       |     ^     |
  |    |       ^   |****       |
North  |     <+ +  |           |
  |    |      + +  |++++       |
       |      + +  |     v     |
         --------------------------
       | G/C=0.517 | G/C=0.317 |
       | G=  31.0" | G=  19.0" |
       | Y+R= 5.0" | Y+R= 5.0" |
       | OFF= 0.0% | OFF=60.0% |
         --------------------------
       C= 60 sec    G= 50.0 sec = 83.3%  Y=10.0 sec = 16.7%  Ped= 0.0 sec =  0.0%
```

Lane Group	Width/ Lanes	g/C Reqd	g/C Used	Service Rate @C (vph)	Service Rate @E	Adj Volume	v/c	HCM Delay	L S	Queue Model 1
SB Approach								12.5	B+	
RT	12/1	0.181	1.000	1583	1583	194	0.123	0.2	A	8 ft
TH	12/1	0.396	0.517	912	962	672	0.699	16.1	*B	448 ft
NB Approach								11.8	B+	
TH	12/1	0.363	0.517	929	962	617	0.641	11.9	B+	352 ft
LT	12/1	0.000	0.517	173	209	28	0.134	7.8	A	12 ft
EB Approach								18.8	B	
RT	12/1	0.081	0.317	423	501	50	0.100	14.9	B+	32 ft
LT	12/1	0.234	0.317	496	560	344	0.614	19.4	*B	235 ft

Institute for Astronomy
Year 2005 with Phase 1
PM Peak Hour of Traffic

12/26/03
09:33:23

SIGNAL2000/TEAPAC[Ver 1.11.00] - Summary of Parameter Values

Intersection Parameters for Int # 0 - Kula Hwy/A'Apueo Pkwy

METROAREA	NONCBD			
SIMULATION PERIOD	15			
LEVELOFSERVICE	C	S		
NODELOCATION	0	0		
QUEUEMODELS	1	90	25	40

Approach Parameters

APPLABELS	SB	WB	NB	EB
GRADES	0.0	0.0	0.0	0.0
PEDLEVELS	0	0	0	0
BIKEVOLUMES	0	0	0	0
PARKINGSIDES	NONE	NONE	NONE	NONE
PARKVOLUMES	20	20	20	20
BUSVOLUMES	0	0	0	0
RIGHTTURNONREDS	0	0	0	0
UPSTREAMVC	0.00	0.00	0.00	0.00

Movement Parameters

MOVLABELS	RT	TH	LT	RT	TH	LT	RT	TH	LT	RT	TH	LT
VOLUMES	175	605	0	0	0	0	0	555	25	45	0	310
WIDTHS	12.0	12.0	0.0	0.0	0.0	0.0	0.0	12.0	12.0	12.0	0.0	12.0
LANES	1	1	0	0	0	0	0	1	1	1	0	1
GROUPTYPES	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM
UTILIZATIONS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRUCKPERCENTS	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
PEAKHOURFACTORS	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
ARRIVALTYPES	2	2	2	3	3	3	3	3	3	3	3	3
ACTUATIONS	NO	YES	YES	NO	YES	YES	NO	YES	YES	NO	YES	YES
REQCLEARANCES	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
MINIMUMS	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
STARTUPLOST	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
ENDGAIN	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
STORAGE	0	0	0	0	0	0	0	0	0	0	0	0
INITIALQUEUE	0	0	0	0	0	0	0	0	0	0	0	0
IDEALSATFLOWS	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
FACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
DELAYFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
NSTOPFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
SATURATIONFLOWS	1583	1863	0	0	0	0	0	1863	405	1583	0	1770

Phasing Parameters

SEQUENCES	11	11					
PERMISSIVES	NO	NO	NO	NO	LEADLAGS	NONE	NONE
OVERLAPS	YES	YES	YES	YES	OFFSET	0.00	1
CYCLES	60	180	60		PEDTIME	0.0	0
GREENTIMES	31.00	19.00					
YELLOWTIMES	5.00	5.00					
CRITICALS	2	12					
EXCESS	0						

ATA AUSTIN, TSUTSUMI & ASSOCIATES, INC.
CIVIL ENGINEERS • SURVEYORS

APPENDIX C

LEVEL OF SERVICE CALCULATIONS

- Base Year 2006

```
Institute for Astronomy                                          01/08/04
AM Peak Hour of Traffic                                          13:57:23
Base Year 2006 with traffic signal

SIGNAL2000/TEAPAC[Ver 1.11.00] - Capacity Analysis Summary

Intersection Averages for Int #   0 - Haleakala Highway/Old Haleakal
      Degree of Saturation (v/c) 1.24  Vehicle Delay 214.6  Level of Service F

       ---------------------------
Sq 11  |  Phase 1  |  Phase 2  |
**/**  ---------------------------
       |           |           |
 /|\   |           |      <****|
  |    |           |           |
  |    |           |           |
North  |    <*     |++++>      |
  |    |     *     |           |
       |     *     |           |
       ---------------------------
       | G/C=0.372 | G/C=0.572 |
       | G=  67.0" | G= 103.0" |
       | Y+R= 5.0" | Y+R= 5.0" |
       | OFF= 0.0% | OFF=40.0% |
       ---------------------------
       C=180 sec   G=170.0 sec = 94.4%  Y=10.0 sec =  5.6%  Ped= 0.0 sec =  0.0%

-----------------------------------------------------------------------------------
| Lane   |Width/|      g/C      | Service Rate|  Adj |       |  HCM  | L | Queue |
|  Group | Lanes| Reqd    Used  | @C (vph) @E |Volume|  v/c  | Delay | S |Model 1|
-----------------------------------------------------------------------------------

NB Approach                                                 252.5   F
===================================================================================
|   LT   | 12/1 |0.616 |0.372 |     1 |  631 |  933 |1.416 | 252.5 |*F |2970 ft|
-----------------------------------------------------------------------------------

WB Approach                                                 245.2   F
===================================================================================
|   TH   | 12/1 |0.868 |0.572 |   649 | 1066 | 1511 |1.417 | 245.2 |*F |4771 ft|
-----------------------------------------------------------------------------------

EB Approach                                                  18.7   B
===================================================================================
|   TH   | 24/2 |0.415 |0.572 |  1700 | 2025 |  417 |0.206 |  18.7 | B | 241 ft|
-----------------------------------------------------------------------------------
```

```
Institute for Astronomy                                                  01/08/04
AM Peak Hour of Traffic                                                  13:57:34
Base Year 2006 with traffic signal

SIGNAL2000/TEAPAC[Ver 1.11.00] - Summary of Parameter Values

   Intersection Parameters for Int #   0 - Haleakala Highway/Old Haleakal
METROAREA            NONCBD
SIMULATION PERIOD        15
LEVELOFSERVICE        C   S
NODELOCATION          0   0
QUEUEMODELS     1  90  25  40

   Approach Parameters
APPLABELS               SB                 WB                 NB                 EB
GRADES                 0.0                0.0                0.0                0.0
PEDLEVELS                0                  0                  0                  0
BIKEVOLUMES              0                  0                  0                  0
PARKINGSIDES          NONE               NONE               NONE               NONE
PARKVOLUMES             20                 20                 20                 20
BUSVOLUMES               0                  0                  0                  0
RIGHTTURNONREDS          0                  0                  0                  0
UPSTREAMVC            0.00               0.00               0.00               0.00

   Movement Parameters
MOVLABELS           RT   TH   LT     RT   TH   LT     RT   TH   LT     RT   TH   LT
VOLUMES              0    0    0      0 1360    0      5    0  840    285  375    0
WIDTHS             0.0  0.0  0.0    0.0 12.0  0.0   12.0  0.0 12.0   12.0 24.0  0.0
LANES                0    0    0      0    1    0      1    0    1      1    2    0
GROUPTYPES        NORM NORM NORM   NORM NORM NORM   FFLW NORM NORM   FFLW NORM NORM
UTILIZATIONS      0.00 0.00 0.00   0.00 0.00 0.00   0.00 0.00 0.00   0.00 0.00 0.00
TRUCKPERCENTS      2.0  2.0  2.0    2.0  2.0  2.0    2.0  2.0  2.0    2.0  2.0  2.0
PEAKHOURFACTORS   0.90 0.90 0.90   0.90 0.90 0.90   0.90 0.90 0.90   0.90 0.90 0.90
ARRIVALTYPES         3    3    3      2    2    2      3    3    3      3    3    3
ACTUATIONS          NO  YES  YES     NO  YES  YES     NO  YES  YES     NO  YES  YES
REQCLEARANCES      5.0  5.0  5.0    5.0  5.0  5.0    5.0  5.0  5.0    5.0  5.0  5.0
MINIMUMS           5.0  5.0  5.0    5.0  5.0  5.0    5.0  5.0  5.0    5.0  5.0  5.0
STARTUPLOST        2.0  2.0  2.0    2.0  2.0  2.0    2.0  2.0  2.0    2.0  2.0  2.0
ENDGAIN            2.0  2.0  2.0    2.0  2.0  2.0    2.0  2.0  2.0    2.0  2.0  2.0
STORAGE              0    0    0      0    0    0      0    0    0      0    0    0
INITIALQUEUE         0    0    0      0    0    0      0    0    0      0    0    0
IDEALSATFLOWS     1900 1900 1900   1900 1900 1900   1900 1900 1900   1900 1900 1900
FACTORS           1.00 1.00 1.00   1.00 1.00 1.00   1.00 1.00 1.00   1.00 1.00 1.00
DELAYFACTORS      1.00 1.00 1.00   1.00 1.00 1.00   1.00 1.00 1.00   1.00 1.00 1.00
NSTOPFACTORS      1.00 1.00 1.00   1.00 1.00 1.00   1.00 1.00 1.00   1.00 1.00 1.00
SATURATIONFLOWS      0    0    0      0 1863    0      0    0 1770      0 3539    0

   Phasing Parameters
SEQUENCES           11     11
PERMISSIVES        YES    YES    YES    YES         LEADLAGS       NONE   NONE
OVERLAPS           YES    YES    YES    YES         OFFSET         0.00      1
CYCLES              90    180     90                PEDTIME         0.0      0
GREENTIMES       67.00 103.00
YELLOWTIMES       5.00   5.00
CRITICALS            9      5
EXCESS               0
```

```
Institute for Astronomy                                              01/08/04
PM Peak Hour of Traffic                                              13:59:14
Base Year 2006 with traffic signal

SIGNAL2000/TEAPAC[Ver 1.11.00] - Capacity Analysis Summary

Intersection Averages for Int #   0 - Haleakala Highway/Old Haleakal
     Degree of Saturation (v/c) 0.72  Vehicle Delay  22.5  Level of Service C+

      -------------------------
Sq 11 |  Phase 1  |  Phase 2  | .
**/** -------------------------
      |           |           |
 /|\  |           |           |
  |   |           |      <****|
  |   |           |           |
North |    <*     |++++>      |
  |   |     *     |           |
      |     *     |           |
      -------------------------
      | G/C=0.318 | G/C=0.571 |
      | G= 28.6"  | G=  51.4" |
      | Y+R= 5.0" | Y+R= 5.0" |
      | OFF= 0.0% | OFF=37.3% |
      -------------------------
     C= 90 sec   G= 80.0 sec = 88.9%  Y=10.0 sec = 11.1%  Ped= 0.0 sec =  0.0%
```

Lane Group	Width/ Lanes	g/C Reqd	g/C Used	Service Rate @C (vph)	Service Rate @E	Adj Volume	v/c	HCM Delay	L S	Queue Model 1
NB Approach								32.7	C	
LT	12/1	0.306	0.318	440	562	417	0.742	32.7	*C	439 ft
WB Approach								30.2	C	
TH	12/1	0.551	0.571	972	1064	928	0.872	30.2	*C	974 ft
EB Approach								12.8	B+	
TH	24/2	0.372	0.571	1988	2022	1178	0.583	12.8	B+	452 ft

```
Institute for Astronomy                                              01/08/04
PM Peak Hour of Traffic                                              13:59:24
Base Year 2006 with traffic signal

SIGNAL2000/TEAPAC[Ver 1.11.00] - Summary of Parameter Values

   Intersection Parameters for Int #   0 - Haleakala Highway/Old Haleakal
METROAREA         NONCBD
SIMULATION PERIOD     15
LEVELOFSERVICE     C   S
NODELOCATION       0   0
QUEUEMODELS    1  90  25  40
```

Approach Parameters

APPLABELS	SB	WB	NB	EB
GRADES	0.0	0.0	0.0	0.0
PEDLEVELS	0	0	0	0
BIKEVOLUMES	0	0	0	0
PARKINGSIDES	NONE	NONE	NONE	NONE
PARKVOLUMES	20	20	20	20
BUSVOLUMES	0	0	0	0
RIGHTTURNONREDS	0	0	0	0
UPSTREAMVC	0.00	0.00	0.00	0.00

Movement Parameters

MOVLABELS	RT	TH	LT	RT	TH	LT	RT	TH	LT	RT	TH	LT
VOLUMES	0	0	0	0	835	0	5	0	375	690	1060	0
WIDTHS	0.0	0.0	0.0	0.0	12.0	0.0	12.0	0.0	12.0	12.0	24.0	0.0
LANES	0	0	0	0	1	0	1	0	1	1	2	0
GROUPTYPES	NORM	NORM	NORM	NORM	NORM	NORM	FFLW	NORM	NORM	FFLW	NORM	NORM
UTILIZATIONS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRUCKPERCENTS	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
PEAKHOURFACTORS	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
ARRIVALTYPES	3	3	3	2	2	2	3	3	3	3	3	3
ACTUATIONS	NO	YES	YES	NO	YES	YES	NO	YES	YES	NO	YES	YES
REQCLEARANCES	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
MINIMUMS	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
STARTUPLOST	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
ENDGAIN	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
STORAGE	0	0	0	0	0	0	0	0	0	0	0	0
INITIALQUEUE	0	0	0	0	0	0	0	0	0	0	0	0
IDEALSATFLOWS	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
FACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
DELAYFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
NSTOPFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
SATURATIONFLOWS	0	0	0	0	1863	0	0	0	1770	0	3539	0

Phasing Parameters

SEQUENCES	11	11					
PERMISSIVES	YES	YES	YES	YES	LEADLAGS	NONE	NONE
OVERLAPS	YES	YES	YES	YES	OFFSET	0.00	1
CYCLES	90	180	90		PEDTIME	0.0	0
GREENTIMES	28.59	51.41					
YELLOWTIMES	5.00	5.00					
CRITICALS	9	5					
EXCESS	0						

```
Institute for Astronomy                                    01/08/04
AM Peak Hour of Traffic                                    13:52:06
Base Year 2006 with traffic signal

SIGNAL2000/TEAPAC[Ver 1.11.00] - Capacity Analysis Summary

Intersection Averages for Int #   0 - Haleakala Highway/Old Haleakal
    Degree of Saturation (v/c) 0.77  Vehicle Delay  10.3  Level of Service B+

      ------------------------
Sq  0 |  Phase 1  |  Phase 2  |
**/** ------------------------
      |           |           |
 /|\  |     <++++|      <****|
  |   |           |           |
  |   |           |           |
North |    <*     |++++>      |
  |   |     *     |           |
      |     *     |           |
      ------------------------
      | G/C=0.722 | G/C=0.167 |
      | G= 65.0"  | G= 15.0"  |
      | Y+R= 5.0" | Y+R= 5.0" |
      | OFF= 0.0% | OFF=77.8% |
      ------------------------
      C= 90 sec   G= 80.0 sec = 88.9%  Y=10.0 sec = 11.1%  Ped= 0.0 sec =  0.0%

---------------------------------------------------------------------------
| Lane  |Width/|     g/C     | Service Rate|  Adj  |       |  HCM  | L | Queue |
| Group | Lanes| Reqd   Used | @C (vph) @E |Volume|  v/c  | Delay | S |Model 1|
---------------------------------------------------------------------------

NB Approach                                              9.5    A
===========================================================================
|  LT   | 12/1 |0.560 |0.722 | 1266 | 1278 |  933 |0.730 |   9.5 |*A | 631 ft|
---------------------------------------------------------------------------

WB Approach                                              2.8    A
===========================================================================
|  TH   | 12/1 |0.829 |1.000 | 1863 | 1863 | 1511 |0.811 |   2.8 |*A | 173 ft|
---------------------------------------------------------------------------

EB Approach                                             39.3    D+
===========================================================================
|  TH   | 24/2 |0.192 |0.167 |  306 |  590 |  417 |0.707 |  39.3 | D+| 256 ft|
---------------------------------------------------------------------------
```

```
Institute for Astronomy                                    01/08/04
AM Peak Hour of Traffic                                    13:52:17
Base Year 2006 with traffic signal

SIGNAL2000/TEAPAC[Ver 1.11.00] - Summary of Parameter Values

   Intersection Parameters for Int #   0 - Haleakala Highway/Old Haleakal
METROAREA           NONCBD
SIMULATION PERIOD       15
LEVELOFSERVICE       C   S
NODELOCATION         0   0
QUEUEMODELS      1  90  25  40

   Approach Parameters
APPLABELS            SB              WB              NB              EB
GRADES              0.0             0.0             0.0             0.0
PEDLEVELS             0               0               0               0
BIKEVOLUMES           0               0               0               0
PARKINGSIDES       NONE            NONE            NONE            NONE
PARKVOLUMES          20              20              20              20
BUSVOLUMES            0               0               0               0
RIGHTTURNONREDS       0               0               0               0
UPSTREAMVC         0.00            0.00            0.00            0.00

   Movement Parameters
MOVLABELS          RT   TH   LT    RT   TH   LT    RT   TH   LT    RT   TH   LT
VOLUMES             0    0    0     0 1360    0     5    0  840   285  375    0
WIDTHS            0.0  0.0  0.0   0.0 12.0  0.0  12.0  0.0 12.0  12.0 24.0  0.0
LANES               0    0    0     0    1    0     1    0    1     1    2    0
GROUPTYPES       NORM NORM NORM  NORM NORM NORM  FFLW NORM NORM  FFLW NORM NORM
UTILIZATIONS     0.00 0.00 0.00  0.00 0.00 0.00  0.00 0.00 0.00  0.00 0.00 0.00
TRUCKPERCENTS     2.0  2.0  2.0   2.0  2.0  2.0   2.0  2.0  2.0   2.0  2.0  2.0
PEAKHOURFACTORS  0.90 0.90 0.90  0.90 0.90 0.90  0.90 0.90 0.90  0.90 0.90 0.90
ARRIVALTYPES        3    3    3     2    2    2     3    3    3     3    3    3
ACTUATIONS         NO  YES  YES    NO  YES  YES    NO  YES  YES    NO  YES  YES
REQCLEARANCES     5.0  5.0  5.0   5.0  5.0  5.0   5.0  5.0  5.0   5.0  5.0  5.0
MINIMUMS          5.0  5.0  5.0   5.0  5.0  5.0   5.0  5.0  5.0   5.0  5.0  5.0
STARTUPLOST       2.0  2.0  2.0   2.0  2.0  2.0   2.0  2.0  2.0   2.0  2.0  2.0
ENDGAIN           2.0  2.0  2.0   2.0  2.0  2.0   2.0  2.0  2.0   2.0  2.0  2.0
STORAGE             0    0    0     0    0    0     0    0    0     0    0    0
INITIALQUEUE        0    0    0     0    0    0     0    0    0     0    0    0
IDEALSATFLOWS    1900 1900 1900  1900 1900 1900  1900 1900 1900  1900 1900 1900
FACTORS          1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00
DELAYFACTORS     1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00
NSTOPFACTORS     1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00
SATURATIONFLOWS     0    0    0     0 1863    0     0    0 1770     0 3539    0
```

Institute for Astronomy
AM Peak Hour of Traffic
Base Year 2006 with traffic signal

01/08/04
13:52:17

SIGNAL2000/TEAPAC[Ver 1.11.00] - Summary of Parameter Values

```
   Phasing Parameters
SEQUENCES            0     0
PERMISSIVES        YES   YES   YES   YES         LEADLAGS      NONE    NONE
OVERLAPS           YES   YES   YES   YES         OFFSET        0.00       1
CYCLES              60   180    10               PEDTIME        0.0       0
GREENTIMES       65.00 15.00
YELLOWTIMES       5.00  5.00
CRITICALS            9     5
EXCESS               0
PHASEMOVEMENTS       1     9     5     0     0     0     0
PHASEMOVEMENTS       2     5    11     0     0     0     0
PHASEMOVEMENTS       3     0     0     0     0     0     0
PHASEMOVEMENTS       4     0     0     0     0     0     0
PHASEMOVEMENTS       5     0     0     0     0     0     0
PHASEMOVEMENTS       6     0     0     0     0     0     0
```

Institute for Astronomy
PM Peak Hour of Traffic
Base Year 2005 with traffic signal

01/08/04
13:55:16

SIGNAL2000/TEAPAC[Ver 1.11.00] - Capacity Analysis Summary

```
Intersection Averages for Int #    0 - Haleakala Highway/Old Haleakal
       Degree of Saturation (v/c) 0.58  Vehicle Delay  11.5  Level of Service B+

         ----------------------------
Sq  0  |  Phase 1   |  Phase 2   |
**/**  ----------------------------
        |            |            |
        |            |            |
 /|\    |      <++++|       <****|
  |     |            |            |
  |     |            |            |
North   |    <*      |++++>       |
  |     |     *      |            |
        |     *      |            |
         ----------------------------
        | G/C=0.322  | G/C=0.567  |
        | G=  29.0"  | G=  51.0"  |
        | Y+R= 5.0"  | Y+R= 5.0"  |
        | OFF= 0.0%  | OFF=37.8%  |
         ----------------------------
        C= 90 sec    G= 80.0 sec = 88.9%  Y=10.0 sec = 11.1%  Ped= 0.0 sec =  0.0%

---------------------------------------------------------------------------------------
| Lane   |Width/|      g/C      | Service Rate|  Adj  |        |  HCM  | L | Queue |
|  Group | Lanes| Reqd    Used  | @C (vph) @E |Volume|   v/c  | Delay | S |Model 1|
---------------------------------------------------------------------------------------
NB Approach                                                      31.9    C
=======================================================================================
|  LT    | 12/1 |0.306 |0.322 |  450  |  570 |  417 |0.732 |  31.9 |*C | 435 ft|
---------------------------------------------------------------------------------------
WB Approach                                                       0.2    A
=======================================================================================
|  TH    | 12/1 |0.551 |1.000 | 1863  | 1863 |  928 |0.498 |   0.2 |*A |  44 ft|
---------------------------------------------------------------------------------------
EB Approach                                                      13.1    B+
=======================================================================================
|  TH    | 24/2 |0.372 |0.567 | 1970  | 2006 | 1178 |0.587 |  13.1 | B+| 456 ft|
---------------------------------------------------------------------------------------
```

Institute for Astronomy
PM Peak Hour of Traffic
Base Year 2005 with traffic signal

01/08/04
13:55:30

SIGNAL2000/TEAPAC[Ver 1.11.00] - Summary of Parameter Values

Intersection Parameters for Int # 0 - Haleakala Highway/Old Haleakal

METROAREA	NONCBD			
SIMULATION PERIOD	15			
LEVELOFSERVICE	C	S		
NODELOCATION	0	0		
QUEUEMODELS	1	90	25	40

Approach Parameters

APPLABELS	SB	WB	NB	EB
GRADES	0.0	0.0	0.0	0.0
PEDLEVELS	0	0	0	0
BIKEVOLUMES	0	0	0	0
PARKINGSIDES	NONE	NONE	NONE	NONE
PARKVOLUMES	20	20	20	20
BUSVOLUMES	0	0	0	0
RIGHTTURNONREDS	0	0	0	0
UPSTREAMVC	0.00	0.00	0.00	0.00

Movement Parameters

MOVLABELS	RT	TH	LT	RT	TH	LT	RT	TH	LT	RT	TH	LT
VOLUMES	0	0	0	0	835	0	5	0	375	690	1060	0
WIDTHS	0.0	0.0	0.0	0.0	12.0	0.0	12.0	0.0	12.0	12.0	24.0	0.0
LANES	0	0	0	0	1	0	1	0	1	1	2	0
GROUPTYPES	NORM	NORM	NORM	NORM	NORM	NORM	FFLW	NORM	NORM	FFLW	NORM	NORM
UTILIZATIONS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRUCKPERCENTS	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
PEAKHOURFACTORS	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
ARRIVALTYPES	3	3	3	2	2	2	3	3	3	3	3	3
ACTUATIONS	NO	YES	YES	NO	YES	YES	NO	YES	YES	NO	YES	YES
REQCLEARANCES	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
MINIMUMS	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
STARTUPLOST	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
ENDGAIN	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
STORAGE	0	0	0	0	0	0	0	0	0	0	0	0
INITIALQUEUE	0	0	0	0	0	0	0	0	0	0	0	0
IDEALSATFLOWS	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
FACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
DELAYFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
NSTOPFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
SATURATIONFLOWS	0	0	0	0	1863	0	0	0	1770	0	3539	0

Institute for Astronomy
PM Peak Hour of Traffic
Base Year 2005 with traffic signal

01/08/04
13:55:30

SIGNAL2000/TEAPAC[Ver 1.11.00] - Summary of Parameter Values

Phasing Parameters

SEQUENCES	0	0					
PERMISSIVES	YES	YES	YES	YES			
OVERLAPS	YES	YES	YES	YES			
CYCLES	60	180	10				
GREENTIMES	29.00	51.00					
YELLOWTIMES	5.00	5.00					
CRITICALS	9	5					
EXCESS	0						
PHASEMOVEMENTS	1	9	5	0	0	0	0
PHASEMOVEMENTS	2	5	11	0	0	0	0
PHASEMOVEMENTS	3	0	0	0	0	0	0
PHASEMOVEMENTS	4	0	0	0	0	0	0
PHASEMOVEMENTS	5	0	0	0	0	0	0
PHASEMOVEMENTS	6	0	0	0	0	0	0

LEADLAGS	NONE	NONE
OFFSET	0.00	1
PEDTIME	0.0	0

Institute for Astronomy
AM Peak Hour of Traffic
Base Year 2006

01/09/04
17:28:55

SIGNAL2000/TEAPAC[Ver 1.11.00] - Capacity Analysis Summary

Intersection Averages for Int # 0 - Haleakala Highway/Makani Road
Degree of Saturation (v/c) 0.74 Vehicle Delay 41.2 Level of Service D+

```
       -------------------------
Sq 11 |  Phase 1  |  Phase 2  |
**/** -------------------------
      | * + +     |         ^ |
      | * + +     |      ****|
 /|\  |<* + +>    |     <****|
  |   |   v       |    ^  ++++|
  |   |      ^    |++++    v |
North |    <+ + +>|++++>     |
  |   |     + + + |++++      |
      |     + + + |   v      |
       -------------------------
      | G/C=0.256 | G/C=0.633 |
      | G=  23.0" | G=  57.0" |
      | Y+R= 5.0" | Y+R= 5.0" |
      | OFF= 0.0% | OFF=31.1% |
       -------------------------
```

C= 90 sec   G= 80.0 sec = 88.9%   Y=10.0 sec = 11.1%   Ped= 0.0 sec = 0.0%

Lane Group	Width/ Lanes	g/C Reqd	g/C Used	Service Rate @C (vph)	Service Rate @E	Adj Volume	v/c	HCM Delay	L S	Queue Model 1
SB Approach								59.7	E+	
RT	12/1	0.341	0.256	232	405	400	0.988	75.1	*E	585 ft
TH+LT	12/1	0.250	0.256	248	367	239	0.651	34.0	C	258 ft
NB Approach								27.6	C	
RT	12/1	0.189	0.256	232	405	106	0.262	28.3	C	107 ft
TH+LT	12/1	0.160	0.256	312	448	117	0.261	27.0	C+	110 ft
WB Approach								46.1	D	
RT+TH	12/1	0.664	0.633	1093	1171	1156	0.987	46.8	*D	1410 ft
LT	12/1	0.136	0.633	543	612	22	0.036	9.1	A	16 ft
EB Approach								7.4	A	
RT+TH	24/2	0.187	0.633	2232	2236	395	0.177	6.9	A	103 ft
LT	12/1	0.225	0.633	59	75	39	0.470	12.8	B+	29 ft

Institute for Astronomy
AM Peak Hour of Traffic
Base Year 2006

01/09/04
17:29:20

SIGNAL2000/TEAPAC[Ver 1.11.00] - Summary of Parameter Values

Intersection Parameters for Int # 0 - Haleakala Highway/Makani Road

METROAREA	NONCBD			
SIMULATION PERIOD	15			
LEVELOFSERVICE	C	S		
NODELOCATION	0	0		
QUEUEMODELS	1	90	25	40

Approach Parameters

APPLABELS	SB	WB	NB	EB
GRADES	0.0	0.0	0.0	0.0
PEDLEVELS	0	0	0	0
BIKEVOLUMES	0	0	0	0
PARKINGSIDES	NONE	NONE	NONE	NONE
PARKVOLUMES	20	20	20	20
BUSVOLUMES	0	0	0	0
RIGHTTURNONREDS	0	0	0	0
UPSTREAMVC	0.00	0.00	0.00	0.00

Movement Parameters

MOVLABELS	RT	TH	LT	RT	TH	LT	RT	TH	LT	RT	TH	LT
VOLUMES	360	100	115	50	990	20	95	90	15	5	350	35
WIDTHS	12.0	12.0	0.0	0.0	12.0	12.0	12.0	12.0	0.0	0.0	24.0	12.0
LANES	1	1	0	0	1	1	1	1	0	0	2	1
GROUPTYPES	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM
UTILIZATIONS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRUCKPERCENTS	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
PEAKHOURFACTORS	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
ARRIVALTYPES	3	3	3	2	2	2	3	3	3	3	3	3
ACTUATIONS	NO	YES	YES	NO	YES	YES	NO	YES	YES	NO	YES	YES
REQCLEARANCES	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
MINIMUMS	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
STARTUPLOST	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
ENDGAIN	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
STORAGE	0	0	0	0	0	0	0	0	0	0	0	0
INITIALQUEUE	0	0	0	0	0	0	0	0	0	0	0	0
IDEALSATFLOWS	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
FACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
DELAYFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
NSTOPFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
SATURATIONFLOWS	1583	1434	0	0	1849	967	1583	1751	0	0	3531	131

Phasing Parameters

SEQUENCES	11	11					
PERMISSIVES	NO	NO	NO	NO	LEADLAGS	NONE	NONE
OVERLAPS	YES	YES	YES	YES	OFFSET	0.00	1
CYCLES	90	180	90		PEDTIME	0.0	0
GREENTIMES	23.00	57.00					
YELLOWTIMES	5.00	5.00					
CRITICALS	1	5					
EXCESS	0						

Institute for Astronomy
PM Peak Hour of Traffic
Base Year 2006

01/07/04
08:33:03

SIGNAL2000/TEAPAC[Ver 1.11.00] - Capacity Analysis Summary

Intersection Averages for Int # 0 - Haleakala Highway/Makani Road
Degree of Saturation (v/c) 0.52 Vehicle Delay 14.3 Level of Service B+

```
         --------------------------
Sq 11  | Phase 1   | Phase 2   |
**/**  --------------------------
       | * + +     |        ^  |
   .   | * + +     |     ++++|
 /|\   |<* + +>    |    <++++|
  |    |   v       |  ^  ++++|
  |    |       ^   |****  v  |
North  |    <+ + +>|++++>      |
  |    |     + + + |++++       |
       |     + + + |  v        |
       --------------------------
       | G/C=0.189 | G/C=0.700 |
       | G= 17.0"  | G= 63.0"  |
       | Y+R= 5.0" | Y+R= 5.0" |
       | OFF= 0.0% | OFF=24.4% |
       --------------------------
C= 90 sec   G= 80.0 sec = 88.9%  Y=10.0 sec = 11.1%  Ped= 0.0 sec =  0.0%
```

Lane Group	Width/ Lanes	g/C Reqd	g/C Used	Service Rate @C (vph)	Service Rate @E	Adj Volume	v/c	HCM Delay	L S	Queue Model 1
SB Approach								32.9	C	
RT	12/1	0.182	0.189	107	289	94	0.314	34.2	*C	104 ft
TH+LT	12/1	0.147	0.189	187	332	83	0.246	31.4	C	84 ft
NB Approach								31.5	C	
RT	12/1	0.141	0.189	107	289	28	0.094	30.8	C	31 ft
TH+LT	12/1	0.150	0.189	192	341	95	0.275	31.7	C	97 ft
WB Approach								14.3	B+	
RT+TH	12/1	0.537	0.700	1235	1297	894	0.689	14.5	B+	758 ft
LT	12/1	0.180	0.700	297	347	33	0.095	7.3	A	23 ft
EB Approach								9.6	A	
RT+TH	24/2	0.324	0.700	2473	2473	978	0.395	5.7	A	252 ft
LT	12/1	0.683	0.700	189	223	183	0.821	30.6	*C	187 ft

Institute for Astronomy
PM Peak Hour of Traffic
Base Year 2006

01/07/04
08:33:11

SIGNAL2000/TEAPAC[Ver 1.11.00] - Summary of Parameter Values

Intersection Parameters for Int # 0 - Haleakala Highway/Makani Road

```
METROAREA          NONCBD
SIMULATION PERIOD      15
LEVELOFSERVICE     C    8
NODELOCATION       0.   0
QUEUEMODELS    1  90  25  40
```

Approach Parameters

APPLABELS	SB	WB	NB	EB
GRADES	0.0	0.0	0.0	0.0
PEDLEVELS	0	0	0	0
BIKEVOLUMES	0	0	0	0
PARKINGSIDES	NONE	NONE	NONE	NONE
PARKVOLUMES	20	20	20	20
BUSVOLUMES	0	0	0	0
RIGHTTURNONREDS	0	0	0	0
UPSTREAMVC	0.00	0.00	0.00	0.00

Movement Parameters

MOVLABELS	RT	TH	LT	RT	TH	LT	RT	TH	LT	RT	TH	LT
VOLUMES	85	65	10	30	775	30	25	80	5	10	870	165
WIDTHS	12.0	12.0	0.0	0.0	12.0	12.0	12.0	12.0	0.0	0.0	24.0	12.0
LANES	1	1	0	0	1	1	1	1	0	0	2	1
GROUPTYPES	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM
UTILIZATIONS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRUCKPERCENTS	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
PEAKHOURFACTORS	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
ARRIVALTYPES	3	3	3	2	2	2	3	3	3	3	3	3
ACTUATIONS	NO	YES	YES	NO	YES	YES	NO	YES	YES	NO	YES	YES
REQCLEARANCES	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
MINIMUMS	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
STARTUPLOST	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
ENDGAIN	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
STORAGE	0	0	0	0	0	0	0	0	0	0	0	0
INITIALQUEUE	0	0	0	0	0	0	0	0	0	0	0	0
IDEALSATFLOWS	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
FACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
DELAYFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
NSTOPFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
SATURATIONFLOWS	1583	1792	0	0	1852	495	1583	1834	0	0	3533	318

Phasing Parameters

SEQUENCES	11	11					
PERMISSIVES	NO	NO	NO	NO	LEADLAGS	NONE	NONE
OVERLAPS	YES	YES	YES	YES	OFFSET	0.00	1
CYCLES	90	180	90		PEDTIME	0.0	0
GREENTIMES	17.00	63.00					
YELLOWTIMES	5.00	5.00					
CRITICALS	1	12					
EXCESS	0						

Institute for Astronomy
AM Peak Hour of Traffic
Base Year 2006

01/07/04
08:34:37

SIGNAL2000/TEAPAC[Ver 1.11.00] - Capacity Analysis Summary

Intersection Averages for Int # 0 - Haleakala Highway/Makawao Aven
Degree of Saturation (v/c) 0.64 Vehicle Delay 60.8 Level of Service E+

```
         -----------------------------------------------
Sq 16  | Phase 1   | Phase 2   | Phase 3   | Phase 4  |
**/**  -----------------------------------------------
       | + + *     | +         | +         |      ^   |
       | + + *     | +         | +         |     ++++ |
 /|\   |<+ + *>    |<+         |<+         |    <**** |
  |    |   v       |   ^  ****|    ^      |          |
  |    |       ^   |++++  v   |****       |          |
North  |   <+ + +> |        +>|++++>      |++++>     |
  |    |     + + + |        + |++++       |++++      |
       |     + + + |        + |    v      |   v      |
         -----------------------------------------------
       | G/C=0.311 | G/C=0.028 | G/C=0.078 | G/C=0.472 |
       | G= 56.0"  | G=  5.0"  | G= 14.0"  | G= 85.0"  |
       | Y+R= 5.0" | Y+R= 5.0" | Y+R= 5.0" | Y+R= 5.0" |
       | OFF= 0.0% | OFF=33.9% | OFF=39.4% | OFF=50.0% |
         -----------------------------------------------
       C=180 sec   G=160.0 sec = 88.9%  Y=20.0 sec = 11.1%  Ped= 0.0 sec = 0.0%
```

Lane Group	Width/ Lanes	g/C Reqd	g/C Used	Service Rate @C (vph)	Service Rate @E	Adj Volume	v/c	HCM Delay	L S	Queue Model 1
SB Approach								61.4	E+	
RT	12/1	0.456	0.472	369	747	311	0.416	32.9	C	443 ft
TH	12/1	0.443	0.311	1	534	361	0.622	55.0	E+	662 ft
LT	12/1	0.491	0.311	1	303	328	0.948	95.5	*F	775 ft
NB Approach								46.0	D	
RT	12/1	0.379	0.367	1	546	11	0.019	36.4	D+	19 ft
TH	12/1	0.402	0.311	1	534	144	0.248	46.5	D	242 ft
LT	12/1	0.403	0.311	1	136	39	0.231	46.7	D	70 ft
WB Approach								62.4	E+	
RT	12/1	0.507	0.472	184	719	300	0.401	38.9	D+	497 ft
TH	12/1	0.623	0.472	244	857	822	0.934	70.8	*E	1706 ft
LT	12/1	0.421	0.028	1	1	6	0.122	86.5	*F	14 ft
EB Approach								61.7	E+	
RT	12/1	0.440	0.578	523	912	72	0.079	22.9	C+	111 ft
TH	24/2	0.455	0.578	1300	2045	317	0.155	23.9	C+	243 ft
LT	12/1	0.471	0.133	1	153	228	0.966	126.5	*F	582 ft

Institute for Astronomy
AM Peak Hour of Traffic
Base Year 2006

01/07/04
08:34:57

SIGNAL2000/TEAPAC[Ver 1.11.00] - Summary of Parameter Values

Intersection Parameters for Int # 0 - Haleakala Highway/Makawao Aven

METROAREA	NONCBD			
SIMULATION PERIOD	15			
LEVELOFSERVICE	C	S		
NODELOCATION	0	0		
QUEUEMODELS	1	90	25	40

Approach Parameters

APPLABELS	SB	WB	NB	EB
GRADES	0.0	0.0	0.0	0.0
PEDLEVELS	0	0	0	0
BIKEVOLUMES	0	0	0	0
PARKINGSIDES	NONE	NONE	NONE	NONE
PARKVOLUMES	20	20	20	20
BUSVOLUMES	0	0	0	0
RIGHTTURNONREDS	0	0	0	0
UPSTREAMVC	0.00	0.00	0.00	0.00

Movement Parameters

MOVLABELS	RT	TH	LT	RT	TH	LT	RT	TH	LT	RT	TH	LT
VOLUMES	280	325	295	270	740	5	10	130	35	65	285	205
WIDTHS	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	24.0	12.0
LANES	1	1	1	1	1	1	1	1	1	1	2	1
GROUPTYPES	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM
UTILIZATIONS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRUCKPERCENTS	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
PEAKHOURFACTORS	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
ARRIVALTYPES	3	3	3	2	2	2	3	3	3	2	2	2
ACTUATIONS	NO	YES	YES	NO	YES	YES	NO	YES	YES	NO	YES	YES
REQCLEARANCES	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
MINIMUMS	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
STARTUPLOST	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
ENDGAIN	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
STORAGE	0	0	0	0	0	0	0	0	0	0	0	0
INITIALQUEUE	0	0	0	0	0	0	0	0	0	0	0	0
IDEALSATFLOWS	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
FACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
DELAYFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
NSTOPFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
SATURATIONFLOWS	1583	1863	1111	1583	1863	1770	1583	1863	543	1583	3539	1770

Phasing Parameters

SEQUENCES	16	16					
PERMISSIVES	NO	NO	NO	NO	LEADLAGS	NONE	NONE
OVERLAPS	YES	YES	YES	YES	OFFSET	0.00	1
CYCLES	180	180	10		PEDTIME	0.0	0
GREENTIMES	56.00	5.00	14.00	85.00			
YELLOWTIMES	5.00	5.00	5.00	5.00			
CRITICALS	3	6	12	5			
EXCESS	0						

Institute for Astronomy
PM Peak Hour of Traffic
Base Year 2006

01/07/04
08:36:14

SIGNAL2000/TEAPAC[Ver 1.11.00] - Capacity Analysis Summary

Intersection Averages for Int #   0 - Haleakala Highway/Makawao Aven
Degree of Saturation (v/c) 0.75 Vehicle Delay 109.3 Level of Service F

```
       -------------------------------------------------
Sq 16 |  Phase 1   |  Phase 2   |  Phase 3   |  Phase 4   |
**/** -------------------------------------------------
      | + + +      | +          | +          |        ^   |
      | + + +      | +          | +          |      ++++  |
 /|\  |<+ + +>     |<+          |<+          |     <****  |
  |   |   v        |    ^  ****|   ^        |            |
  |   |      ^     |++++   v    |****        |            |
North |    <+ * +> |         +> |++++>       |++++>       |
  |   |     + * +  |         +  |++++        |++++        |
      |     + * +  |         +  |   v        |   v        |
       -------------------------------------------------
      | G/C=0.372  | G/C=0.033  | G/C=0.089  | G/C=0.394  |
      | G=  67.0"  | G=   6.0"  | G=  16.0"  | G=  71.0"  |
      | Y+R= 5.0"  | Y+R= 5.0"  | Y+R= 5.0"  | Y+R= 5.0"  |
      | OFF= 0.0%  | OFF=40.0%  | OFF=46.1%  | OFF=57.8%  |
       -------------------------------------------------
      C=180 sec   G=160.0 sec = 88.9%  Y=20.0 sec = 11.1%  Ped= 0.0 sec =  0.0%
```

Lane Group	Width/ Lanes	g/C Reqd	g/C Used	Service Rate @C (vph)	Service Rate @E	Adj Volume	v/c	HCM Delay	L S	Queue Model 1
SB Approach								297.4	F	
RT	12/1	0.419	0.550	623	871	172	0.197	21.0	C+	204 ft
TH	12/1	0.445	0.372	1	666	372	0.537	45.2	D	623 ft
LT	12/1	1.000	0.372	1	41	183	3.155	1069.8	F	960 ft
NB Approach								62.6	E+	
RT	12/1	0.382	0.433	227	673	22	0.032	29.4	C	33 ft
TH	12/1	0.503	0.372	1	666	617	0.890	66.7	*E+	1252 ft
LT	12/1	0.427	0.372	1	208	89	0.374	42.2	D+	154 ft
WB Approach								62.6	E+	
RT	12/1	0.504	0.394	1	577	289	0.462	48.1	D	514 ft
TH	12/1	0.571	0.394	1	694	644	0.876	68.7	*E	1310 ft
LT	12/1	0.422	0.033	1	1	11	0.186	86.2	*F	26 ft
EB Approach								49.9	D	
RT	12/1	0.481	0.511	313	790	211	0.261	31.9	C	331 ft
TH	24/2	0.480	0.511	798	1809	539	0.298	31.9	C	448 ft
LT	12/1	0.474	0.150	1	184	239	0.902	106.2	*F	577 ft

Institute for Astronomy
PM Peak Hour of Traffic
Base Year 2006

01/07/04
08:36:20

SIGNAL2000/TEAPAC[Ver 1.11.00] - Summary of Parameter Values

Intersection Parameters for Int #   0 - Haleakala Highway/Makawao Aven

METROAREA	NONCBD			
SIMULATION PERIOD	15			
LEVELOFSERVICE	C	S		
NODELOCATION	0	0		
QUEUEMODELS	1	90	25	40

Approach Parameters

APPLABELS	SB	WB	NB	EB
GRADES	0.0	0.0	0.0	0.0
PEDLEVELS	0	0	0	0
BIKEVOLUMES	0	0	0	0
PARKINGSIDES	NONE	NONE	NONE	NONE
PARKVOLUMES	20	20	20	20
BUSVOLUMES	0	0	0	0
RIGHTTURNONREDS	0	0	0	0
UPSTREAMVC	0.00	0.00	0.00	0.00

Movement Parameters

MOVLABELS	RT	TH	LT	RT	TH	LT	RT	TH	LT	RT	TH	LT
VOLUMES	155	335	165	260	580	10	20	555	80	190	485	215
WIDTHS	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	24.0	12.0
LANES	1	1	1	1	1	1	1	1	1	1	2	1
GROUPTYPES	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM
UTILIZATIONS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRUCKPERCENTS	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
PEAKHOURFACTORS	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
ARRIVALTYPES	3	3	3	2	2	2	3	3	3	2	2	2
ACTUATIONS	NO	YES	YES	NO	YES	YES	NO	YES	YES	NO	YES	YES
REQCLEARANCES	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
MINIMUMS	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
STARTUPLOST	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
ENDGAIN	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
STORAGE	0	0	0	0	0	0	0	0	0	0	0	0
INITIALQUEUE	0	0	0	0	0	0	0	0	0	0	0	0
IDEALSATFLOWS	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
FACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
DELAYFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
NSTOPFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
SATURATIONFLOWS	1583	1863	157	1583	1863	1770	1583	1863	639	1583	3539	1770

Phasing Parameters

SEQUENCES	16	16		
PERMISSIVES	NO	NO	NO	NO
OVERLAPS	YES	YES	YES	YES
CYCLES	60	180	10	
GREENTIMES	67.00	6.00	16.00	71.00
YELLOWTIMES	5.00	5.00	5.00	5.00
CRITICALS	8	6	12	5
EXCESS	0			

LEADLAGS	NONE	NONE
OFFSET	0.00	1
PEDTIME	0.0	0

Institute for Astronomy
AM Peak Hour of Traffic
Base Year 2006

01/07/04
08:37:30

SIGNAL2000/TEAPAC[Ver 1.11.00] - Capacity Analysis Summary

Intersection Averages for Int # 0 - Kula Highway/Haleakala Highway
Degree of Saturation (v/c) 0.88 Vehicle Delay 50.9 Level of Service D

```
        --------------------------------------------
Sq 61  |  Phase 1  |  Phase 2  |  Phase 3  |  Phase 4  |
**/**   --------------------------------------------
       |     *     |           | + +       |           |
   .   |     *     |           | + +       |           |
  /|\  |     *>    |           |<+ +       |     <****|
   |   |           |           |    v      |   ^  ****|
   |   |           |        ^  |         ^ |++++   v   |
North  |    <+     |     <* +  |         * |++++>      |
   |   |     +     |      * +  |         * |           |
       |     +     |      * +  |         * |           |
        --------------------------------------------
       | G/C=0.078 | G/C=0.089 | G/C=0.367 | G/C=0.244 |
       | G=   7.0" | G=   8.0" | G=  33.0" | G=  22.0" |
       | Y+R= 5.0" | Y+R= 5.0" | Y+R= 5.0" | Y+R= 5.0" |
       | OFF= 0.0% | OFF=13.3% | OFF=27.8% | OFF=70.0% |
        --------------------------------------------
       C= 90 sec   G= 70.0 sec = 77.8%  Y=20.0 sec = 22.2%  Ped= 0.0 sec =  0.0%
```

Lane Group	Width/ Lanes	g/C Reqd	g/C Used	Service Rate @C (vph)	Service Rate @E	Adj Volume	v/c	HCM Delay	L S	Queue Model 1
SB Approach								38.8	D+	
RT	12/1	0.123	0.367	422	581	6	0.010	20.1	C+	6 ft
TH	12/1	0.374	0.367	546	683	561	0.821	36.6	D+	620 ft
LT	12/1	0.152	0.078	1	119	94	0.681	53.3	*D	121 ft
NB Approach								54.5	D	
TH	12/1	0.556	0.511	846	952	939	0.986	53.0	*D	1178 ft
LT	12/1	0.284	0.222	242	392	356	0.906	58.7	*E+	463 ft
WB Approach								75.6	E	
TH+LT	12/1	0.317	0.244	192	294	289	0.963	75.6	*E	416 ft
EB Approach								29.0	C	
TH+LT	12/1	0.182	0.244	306	449	178	0.396	29.0	C	175 ft

Institute for Astronomy
AM Peak Hour of Traffic
Base Year 2006

01/07/04
08:37:44

SIGNAL2000/TEAPAC[Ver 1.11.00] - Summary of Parameter Values

Intersection Parameters for Int # 0 - Kula Highway/Haleakala Highway

METROAREA	NONCBD			
SIMULATION PERIOD	15			
LEVELOFSERVICE	C	S		
NODELOCATION	0	0		
QUEUEMODELS	1	90	25	40

Approach Parameters

APPLABELS	SB	WB	NB	EB
GRADES	0.0	0.0	0.0	0.0
PEDLEVELS	0	0	0	0
BIKEVOLUMES	0	0	0	0
PARKINGSIDES	NONE	NONE	NONE	NONE
PARKVOLUMES	20	20	20	20
BUSVOLUMES	0	0	0	0
RIGHTTURNONREDS	0	0	0	0
UPSTREAMVC	0.00	0.00	0.00	0.00

Movement Parameters

MOVLABELS	RT	TH	LT	RT	TH	LT	RT	TH	LT	RT	TH	LT
VOLUMES	5	505	85	170	120	140	140	845	320	525	155	5
WIDTHS	12.0	12.0	12.0	12.0	12.0	0.0	12.0	12.0	12.0	12.0	12.0	0.0
LANES	1	1	1	1	1	0	1	1	1	1	1	0
GROUPTYPES	NORM	NORM	NORM	FFLW	NORM	NORM	FFLW	NORM	NORM	FFLW	NORM	NORM
UTILIZATIONS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRUCKPERCENTS	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
PEAKHOURFACTORS	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
ARRIVALTYPES	2	2	2	3	3	3	2	2	2	3	3	3
ACTUATIONS	NO	YES	YES	NO	YES	YES	NO	YES	YES	NO	YES	YES
REQCLEARANCES	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
MINIMUMS	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
STARTUPLOST	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
ENDGAIN	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
STORAGE	0	0	0	0	0	0	0	0	0	0	0	0
INITIALQUEUE	0	0	0	0	0	0	0	0	0	0	0	0
IDEALSATFLOWS	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
FACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
DELAYFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
NSTOPFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
SATURATIONFLOWS	1583	1863	1770	0	1226	0	0	1863	1770	0	1839	0

Phasing Parameters

SEQUENCES	61	61					
PERMISSIVES	NO	NO	NO	NO	LEADLAGS	NONE	NONE
OVERLAPS	YES	YES	YES	YES	OFFSET	0.00	1
CYCLES	90	180	90		PEDTIME	0.0	0
GREENTIMES	7.00	8.00	33.00	22.00			
YELLOWTIMES	5.00	5.00	5.00	5.00			
CRITICALS	3	9	8	5			
EXCESS	0						

Institute for Astronomy
PM Peak Hour of Traffic
Base Year 2006

01/07/04
08:38:38

SIGNAL2000/TEAPAC[Ver 1.11.00] - Capacity Analysis Summary

Intersection Averages for Int # 0 - Kula Highway/Haleakala Highway
Degree of Saturation (v/c) 0.83 Vehicle Delay 41.2 Level of Service D+

```
         ---------------------------------------------
Sq 61  |  Phase 1  |  Phase 2  |  Phase 3  |  Phase 4  |
**/**  ---------------------------------------------
       |     *     |           | + *       |           |
   .   |     *     |           | + *       |           |
  /|\  |     *>    |           |<+ *       |     <****|
   |   |           |           |   v       |   ^   ****|
   |   |           |       ^   |       ^   |++++   v   |
North  |    <+     |     <* +  |       +   |++++>      |
   |   |     +     |      * +  |       +   |           |
       |     +     |      * +  |       +   |           |
       ---------------------------------------------
       | G/C=0.056 | G/C=0.178 | G/C=0.400 | G/C=0.144 |
       | G=   5.0" | G=  16.0" | G=  36.0" | G=  13.0" |
       | Y+R= 5.0" | Y+R= 5.0" | Y+R= 5.0" | Y+R= 5.0" |
       | OFF= 0.0% | OFF=11.1% | OFF=34.4% | OFF=80.0% |
       ---------------------------------------------
       C= 90 sec   G= 70.0 sec = 77.8%  Y=20.0 sec = 22.2%  Ped= 0.0 sec =  0.0%
```

Lane Group	Width/ Lanes	g/C Reqd	g/C Used	Service Rate @C (vph)	Service Rate @E	Adj Volume	v/c	HCM Delay	L S	Queue Model 1
SB Approach								53.3	D	
RT	12/1	0.123	0.400	484	633	6	0.009	18.5	B	6 ft
TH	12/1	0.446	0.400	615	745	711	0.954	52.2	*D	883 ft
LT	12/1	0.144	0.056	1	80	72	0.735	66.5	*E+	98 ft
NB Approach								32.9	C	
TH	12/1	0.526	0.633	1102	1180	878	0.744	19.4	B	804 ft
LT	12/1	0.348	0.289	366	511	478	0.935	57.7	*E+	616 ft
WB Approach								54.4	D	
TH+LT	12/1	0.200	0.144	59	198	167	0.784	54.4	*D	212 ft
EB Approach								35.8	D+	
TH+LT	12/1	0.152	0.144	77	251	100	0.379	35.8	D+	109 ft

Institute for Astronomy
PM Peak Hour of Traffic
Base Year 2006

01/07/04
08:38:51

SIGNAL2000/TEAPAC[Ver 1.11.00] - Summary of Parameter Values

Intersection Parameters for Int # 0 - Kula Highway/Haleakala Highway

METROAREA	NONCBD			
SIMULATION PERIOD	15			
LEVELOFSERVICE	C	S		
NODELOCATION	0	0		
QUEUEMODELS	1	90	25	40

Approach Parameters

APPLABELS	SB	WB	NB	EB
GRADES	0.0	0.0	0.0	0.0
PEDLEVELS	0	0	0	0
BIKEVOLUMES	0	0	0	0
PARKINGSIDES	NONE	NONE	NONE	NONE
PARKVOLUMES	20	20	20	20
BUSVOLUMES	0	0	0	0
RIGHTTURNONREDS	0	0	0	0
UPSTREAMVC	0.00	0.00	0.00	0.00

Movement Parameters

MOVLABELS	RT	TH	LT	RT	TH	LT	RT	TH	LT	RT	TH	LT
VOLUMES	5	640	65	80	80	70	55	790	430	410	85	5
WIDTHS	12.0	12.0	12.0	12.0	12.0	0.0	12.0	12.0	12.0	12.0	12.0	0.0
LANES	1	1	1	1	1	0	1	1	1	1	1	0
GROUPTYPES	NORM	NORM	NORM	FFLW	NORM	NORM	FFLW	NORM	NORM	FFLW	NORM	NORM
UTILIZATIONS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRUCKPERCENTS	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
PEAKHOURFACTORS	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
ARRIVALTYPES	2	2	2	3	3	3	2	2	2	3	3	3
ACTUATIONS	NO	YES	YES	NO	YES	YES	NO	YES	YES	NO	YES	YES
REQCLEARANCES	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
MINIMUMS	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
STARTUPLOST	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
ENDGAIN	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
STORAGE	0	0	0	0	0	0	0	0	0	0	0	0
INITIALQUEUE	0	0	0	0	0	0	0	0	0	0	0	0
IDEALSATFLOWS	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
FACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
DELAYFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
NSTOPFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
SATURATIONFLOWS	1583	1863	1770	0	1473	0	0	1863	1770	0	1830	0

Phasing Parameters

SEQUENCES	61	61		
PERMISSIVES	NO	NO	NO	NO
OVERLAPS	YES	YES	YES	YES
CYCLES	90	180	90	
GREENTIMES	5.00	16.00	36.00	13.00
YELLOWTIMES	5.00	5.00	5.00	5.00
CRITICALS	3	9	2	5
EXCESS	0			

LEADLAGS	NONE	NONE
OFFSET	0.00	1
PEDTIME	0.0	0

Institute for Astronomy
AM Peak Hour of Traffic
Base Year 2006

01/07/04
08:48:42

SIGNAL2000/TEAPAC[Ver 1.11.00] - Capacity Analysis Summary

Intersection Averages for Int # 0 - Old Haleakala Hwy/Pukalani St
Degree of Saturation (v/c) 0.57 Vehicle Delay 16.9 Level of Service B

```
      ---------------------------------------
Sq  0 |  Phase 1  |  Phase 2  |  Phase 3  |
**/** ---------------------------------------
      |           |           |           |
  .   |           |           |           |
 /|\  |           |      <++++|      <++++|
  |   |           |       ****|       ++++|
  |   |           |      v    |      v    |
North |    <+   *>|        +> |++++>      |
  |   |++++ +   * |        +  |++++       |
      |   v +   * |        +  |  v        |
      ---------------------------------------
      | G/C=0.450 | G/C=0.083 | G/C=0.300 |
      | G=  27.0" | G=   5.0" | G=  18.0" |
      | Y+R= 5.0" | Y+R= 5.0" | Y+R= 0.0" |
      | OFF= 0.0% | OFF=53.3% | OFF=70.0% |
      ---------------------------------------
      C= 60 sec   G= 50.0 sec = 83.3%  Y=10.0 sec = 16.7%  Ped= 0.0 sec =  0.0%
```

Lane Group	Width/ Lanes	g/C Reqd	g/C Used	Service Rate @C (vph)	Service Rate @E	Adj Volume	v/c	HCM Delay	L S	Queue Model 1
NB Approach								15.3	B	
RT	12/1	0.281	0.617	955	976	361	0.370	6.8	*A	154 ft
LT	12/1	0.392	0.450	750	796	639	0.803	20.2	C+	451 ft
WB Approach								24.1	C+	
TH	12/1	0.182	0.383	658	714	267	0.374	13.6	B+	152 ft
LT	12/1	0.077	0.083	391	444	378	0.851	31.4	*C	312 ft
EB Approach								8.9	A	
RT	12/1	0.212	0.750	1188	1188	244	0.205	2.6	A	69 ft
TH	12/1	0.105	0.217	332	404	133	0.329	20.3	C+	90 ft

Institute for Astronomy
AM Peak Hour of Traffic
Base Year 2006

01/07/04
08:48:54

SIGNAL2000/TEAPAC[Ver 1.11.00] - Summary of Parameter Values

Intersection Parameters for Int # 0 - Old Haleakala Hwy/Pukalani St

METROAREA	NONCBD			
SIMULATION PERIOD	15			
LEVELOFSERVICE	C	S		
NODELOCATION	0	0		
QUEUEMODELS	1	90	25	40

Approach Parameters

APPLABELS	SB	WB	NB	EB
GRADES	0.0	0.0	0.0	0.0
PEDLEVELS	0	0	0	0
BIKEVOLUMES	0	0	0	0
PARKINGSIDES	NONE	NONE	NONE	NONE
PARKVOLUMES	20	20	20	20
BUSVOLUMES	0	0	0	0
RIGHTTURNONREDS	0	0	0	0
UPSTREAMVC	0.00	0.00	0.00	0.00

Movement Parameters

MOVLABELS	RT	TH	LT	RT	TH	LT	RT	TH	LT	RT	TH	LT
VOLUMES	0	0	0	0	240	340	325	0	575	220	120	0
WIDTHS	0.0	0.0	0.0	0.0	12.0	12.0	12.0	0.0	12.0	12.0	12.0	0.0
LANES	0	0	0	0	1	1	1	0	1	1	1	0
GROUPTYPES	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM
UTILIZATIONS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRUCKPERCENTS	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
PEAKHOURFACTORS	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
ARRIVALTYPES	3	3	3	3	3	3	3	3	3	3	3	3
ACTUATIONS	NO	YES	YES	NO	YES	YES	NO	YES	YES	NO	YES	YES
REQCLEARANCES	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
MINIMUMS	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
STARTUPLOST	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
ENDGAIN	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
STORAGE	0	0	0	0	0	0	0	0	0	0	0	0
INITIALQUEUE	0	0	0	0	0	0	0	0	0	0	0	0
IDEALSATFLOWS	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
FACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
DELAYFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
NSTOPFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
SATURATIONFLOWS	0	0	0	0	1863	1770	1583	0	1770	1583	1863	0

Institute for Astronomy
AM Peak Hour of Traffic
Base Year 2006

01/07/04
08:48:54

SIGNAL2000/TEAPAC[Ver 1.11.00] - Summary of Parameter Values

Phasing Parameters

SEQUENCES	0	0					
PERMISSIVES	YES	YES	YES	YES			
OVERLAPS	YES	YES	YES	YES			
CYCLES	60	120	10				
GREENTIMES	27.00	5.00	18.00				
YELLOWTIMES	5.00	5.00	0.00				
CRITICALS	7	6	2				
EXCESS	0						
PHASEMOVEMENTS	1	7	9	10	0	0	0
PHASEMOVEMENTS	2	6	7	5	0	0	0
PHASEMOVEMENTS	3	5	10	11	-6	0	0
PHASEMOVEMENTS	4	0	0	0	0	0	0
PHASEMOVEMENTS	5	0	0	0	0	0	0
PHASEMOVEMENTS	6	0	0	0	0	0	0

LEADLAGS	NONE	NONE
OFFSET	0.00	1
PEDTIME	0.0	0

Institute for Astronomy
PM Peak Hour of Traffic
Base Year 2006

01/07/04
08:50:06

SIGNAL2000/TEAPAC[Ver 1.11.00] - Capacity Analysis Summary

Intersection Averages for Int # 0 - Old Haleakala Hwy/Pukalani St
Degree of Saturation (v/c) 0.65 Vehicle Delay 21.4 Level of Service C+

```
        ----------------------------------------
Sq  0 | Phase 1  | Phase 2  | Phase 3  |
**/** ----------------------------------------
      |          |          |          |
  .   |          |          |          |
 /|\  |          |     <++++|     <++++|
  |   |          |      ****|      ++++|
  |   |          |     v    |     v    |
North |    <+   *>|       +>|++++>     |
  |   |++++ +   * |       + |++++      |
      |   v +   * |       + |   v      |
        ----------------------------------------
      | G/C=0.217 | G/C=0.083 | G/C=0.533 |
      | G=  13.0" | G=   5.0" | G=  32.0" |
      | Y+R= 5.0" | Y+R= 5.0" | Y+R= 0.0" |
      | OFF= 0.0% | OFF=30.0% | OFF=46.7% |
        ----------------------------------------
      C= 60 sec   G= 50.0 sec = 83.3%   Y=10.0 sec = 16.7%   Ped= 0.0 sec =  0.0%
```

Lane Group	Width/ Lanes	g/C Reqd	g/C Used	Service Rate @C (vph)	Service Rate @E	Adj Volume	v/c	HCM Delay	L S	Queue Model 1
NB Approach								29.1	C	
RT	12/1	0.341	0.383	541	607	467	0.769	25.3	*C+	347 ft
LT	12/1	0.216	0.217	312	383	311	0.812	34.8	C	261 ft
WB Approach								28.3	C	
TH	12/1	0.161	0.617	1136	1149	228	0.198	5.1	A	81 ft
LT	12/1	0.086	0.083	606	637	611	0.959	37.0	*D+	558 ft
EB Approach								6.2	A	
RT	12/1	0.370	0.750	1188	1188	517	0.435	3.9	A	172 ft
TH	12/1	0.179	0.450	793	838	261	0.311	10.8	B+	132 ft

Institute for Astronomy
PM Peak Hour of Traffic
Base Year 2006

01/07/04
08:51:14

SIGNAL2000/TEAPAC[Ver 1.11.00] - Summary of Parameter Values

Intersection Parameters for Int # 0 - Old Haleakala Hwy/Pukalani St

METROAREA	NONCBD			
SIMULATION PERIOD	15			
LEVELOFSERVICE	C	S		
NODELOCATION	0	0		
QUEUEMODELS	1	90	25	40

Approach Parameters

APPLABELS	SB	WB	NB	EB
GRADES	0.0	0.0	0.0	0.0
PEDLEVELS	0	0	0	0
BIKEVOLUMES	0	0	0	0
PARKINGSIDES	NONE	NONE	NONE	NONE
PARKVOLUMES	20	20	20	20
BUSVOLUMES	0	0	0	0
RIGHTTURNONREDS	0	0	0	0
UPSTREAMVC	0.00	0.00	0.00	0.00

Movement Parameters

MOVLABELS	RT	TH	LT	RT	TH	LT	RT	TH	LT	RT	TH	LT
VOLUMES	0	0	0	0	205	550	420	0	280	465	235	0
WIDTHS	0.0	0.0	0.0	0.0	12.0	12.0	12.0	0.0	12.0	12.0	12.0	0.0
LANES	0	0	0	0	1	1	1	0	1	1	1	0
GROUPTYPES	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM
UTILIZATIONS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRUCKPERCENTS	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
PEAKHOURFACTORS	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
ARRIVALTYPES	3	3	3	3	3	3	3	3	3	3	3	3
ACTUATIONS	NO	YES	YES	NO	YES	YES	NO	YES	YES	NO	YES	YES
REQCLEARANCES	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
MINIMUMS	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
STARTUPLOST	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
ENDGAIN	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
STORAGE	0	0	0	0	0	0	0	0	0	0	0	0
INITIALQUEUE	0	0	0	0	0	0	0	0	0	0	0	0
IDEALSATFLOWS	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
FACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
DELAYFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
NSTOPFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
SATURATIONFLOWS	0	0	0	0	1863	1770	1583	0	1770	1583	1863	0

Institute for Astronomy
PM Peak Hour of Traffic
Base Year 2006

01/07/04
08:51:14

SIGNAL2000/TEAPAC[Ver 1.11.00] - Summary of Parameter Values

Phasing Parameters

SEQUENCES	0	0					
PERMISSIVES	YES	YES	YES	YES			
OVERLAPS	YES	YES	YES	YES			
CYCLES	60	120	10				
GREENTIMES	13.00	5.00	32.00				
YELLOWTIMES	5.00	5.00	0.00				
CRITICALS	7	6	2				
EXCESS	0						
PHASEMOVEMENTS	1	7	9	10	0	0	0
PHASEMOVEMENTS	2	6	7	5	0	0	0
PHASEMOVEMENTS	3	5	10	11	-6	0	0
PHASEMOVEMENTS	4	0	0	0	0	0	0
PHASEMOVEMENTS	5	0	0	0	0	0	0
PHASEMOVEMENTS	6	0	0	0	0	0	0

LEADLAGS	NONE	NONE
OFFSET	0.00	1
PEDTIME	0.0	0

Institute for Astronomy
AM Peak Hour of Traffic
Base Year 2006

01/07/04
08:45:50

SIGNAL2000/TEAPAC[Ver 1.11.00] - Capacity Analysis Summary

```
Intersection Averages for Int #   0 - Old Haleakala Highway/Makawao
      Degree of Saturation (v/c) 0.59  Vehicle Delay  17.2   Level of Service B

      ------------------------------------
Sq  0 |  Phase 1  |  Phase 2  |  Phase 3  |
**/** ------------------------------------
      | + * *     |           |      ^    |
  .   | + * *     |           |      ****|
 /|\  |<+ * *>    |           |    <****|
  |   |   v       |     ^     |  ^   ****|
  |   |       ^   |++++       |++++   v   |
North |     <+ + +>|++++>      |++++>      |
  |   |      + + + |++++       |++++       |
      |      + + + |    v      |   v       |
      ------------------------------------
      | G/C=0.300 | G/C=0.050 | G/C=0.400 |
      | G=  18.0" | G=   3.0" | G=  24.0" |
      | Y+R= 5.0" | Y+R= 5.0" | Y+R= 5.0" |
      | OFF= 0.0% | OFF=38.3% | OFF=51.7% |
      ------------------------------------
      C= 60 sec   G= 45.0 sec = 75.0%  Y=15.0 sec = 25.0%  Ped= 0.0 sec =  0.0%
```

Lane Group	Width/ Lanes	g/C Reqd	g/C Used	Service Rate @C (vph)	Service Rate @E	Adj Volume	v/c	HCM Delay	L S	Queue Model 1
SB Approach								20.3	C+	
RT	12/1	0.219	0.300	395	475	256	0.539	21.9	C+	180 ft
TH+LT	12/1	0.130	0.300	303	363	105	0.289	16.5	*B	65 ft
NB Approach								23.5	C+	
RT+TH+LT	12/1	0.255	0.300	427	492	350	0.711	23.5	C+	258 ft
WB Approach								20.5	C+	
RT+TH+LT	12/1	0.340	0.400	594	648	489	0.755	20.5	*C+	346 ft
EB Approach								9.2	A	
RT+TH	12/1	0.314	0.533	957	987	516	0.523	9.6	A	263 ft
LT	12/1	0.084	0.533	913	944	94	0.100	6.9	A	37 ft

Institute for Astronomy
AM Peak Hour of Traffic
Base Year 2006

01/07/04
08:46:09

SIGNAL2000/TEAPAC[Ver 1.11.00] - Summary of Parameter Values

Intersection Parameters for Int #   0 - Old Haleakala Highway/Makawao

METROAREA	NONCBD			
SIMULATION PERIOD	15			
LEVELOFSERVICE	C	S		
NODELOCATION	0	0		
QUEUEMODELS	1	90	25	40

Approach Parameters

APPLABELS	SB	WB	NB	EB
GRADES	0.0	0.0	0.0	0.0
PEDLEVELS	0	0	0	0
BIKEVOLUMES	0	0	0	0
PARKINGSIDES	NONE	NONE	NONE	NONE
PARKVOLUMES	20	20	20	20
BUSVOLUMES	0	0	0	0
RIGHTTURNONREDS	0	0	0	0
UPSTREAMVC	0.00	0.00	0.00	0.00

Movement Parameters

MOVLABELS	RT	TH	LT	RT	TH	LT	RT	TH	LT	RT	TH	LT
VOLUMES	230	40	55	65	320	55	205	80	30	20	445	85
WIDTHS	12.0	12.0	0.0	0.0	12.0	0.0	0.0	12.0	0.0	0.0	12.0	12.0
LANES	1	1	0	0	1	0	0	1	0	0	1	1
GROUPTYPES	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM
UTILIZATIONS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRUCKPERCENTS	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
PEAKHOURFACTORS	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
ARRIVALTYPES	3	3	3	3	3	3	3	3	3	3	3	3
ACTUATIONS	NO	YES	YES	NO	YES	YES	NO	YES	YES	NO	YES	YES
REQCLEARANCES	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
MINIMUMS	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
STARTUPLOST	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
ENDGAIN	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
STORAGE	0	0	0	0	0	0	0	0	0	0	0	0
INITIALQUEUE	0	0	0	0	0	0	0	0	0	0	0	0
IDEALSATFLOWS	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
FACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
DELAYFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
NSTOPFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
SATURATIONFLOWS	1583	1210	0	0	1620	0	0	1640	0	0	1851	1770

Institute for Astronomy
AM Peak Hour of Traffic
Base Year 2006

01/07/04
08:46:09

SIGNAL2000/TEAPAC[Ver 1.11.00] - Summary of Parameter Values

Phasing Parameters

SEQUENCES	0	0					
PERMISSIVES	NO	NO	NO	NO			
OVERLAPS	YES	YES	YES	YES			
CYCLES	60	120	10				
GREENTIMES	18.00	3.00	24.00				
YELLOWTIMES	5.00	5.00	5.00				
CRITICALS	2	6	5				
EXCESS	0						
PHASEMOVEMENTS	1	1	2	3	7	8	9
PHASEMOVEMENTS	2	10	11	12	0	0	0
PHASEMOVEMENTS	3	4	5	6	10	11	12
PHASEMOVEMENTS	4	0	0	0	0	0	0
PHASEMOVEMENTS	5	0	0	0	0	0	0
PHASEMOVEMENTS	6	0	0	0	0	0	0

LEADLAGS	NONE	NONE
OFFSET	0.00	1
PEDTIME	0.0	0

Institute for Astronomy
PM Peak Hour of Traffic
Base Year 2006

01/07/04
08:47:15

SIGNAL2000/TEAPAC[Ver 1.11.00] - Capacity Analysis Summary

Intersection Averages for Int # 0 - Old Haleakala Highway/Makawao
Degree of Saturation (v/c) 0.62 Vehicle Delay 21.3 Level of Service C+

```
Sq  0 | Phase 1  | Phase 2  | Phase 3  |
**/** --------------------------------
      | + + *    |          |        ^ |
      | + + *    |          |     ****|
 /|\  |<+ + +>   |          |    <****|
  |   |  v       |     ^    |   ^ ****|
  |   |     ^    |++++      |++++  v  |
North |  <+ + +> |++++>     |++++>    |
  |   |   + + +  |++++      |++++     |
      |   + + +  |    v     |   v     |
      --------------------------------
      | G/C=0.300 | G/C=0.050 | G/C=0.400 |
      | G= 18.0"  | G=  3.0"  | G= 24.0"  |
      | Y+R= 5.0" | Y+R= 5.0" | Y+R= 5.0" |
      | OFF= 0.0% | OFF=38.3% | OFF=51.7% |
      --------------------------------
```

C= 60 sec G= 45.0 sec = 75.0% Y=15.0 sec = 25.0% Ped= 0.0 sec = 0.0%

Lane Group	Width/ Lanes	g/C Reqd	g/C Used	Service Rate @C (vph)	Service Rate @E	Adj Volume	v/c	HCM Delay	L S	Queue Model 1
SB Approach								31.5	C	
RT	12/1	0.303	0.300	395	475	400	0.842	36.1	D+	340 ft
TH+LT	12/1	0.120	0.300	387	450	122	0.271	16.3	*B	75 ft
NB Approach								16.2	B	
RT+TH+LT	12/1	0.112	0.300	440	505	128	0.253	16.2	B	78 ft
WB Approach								30.4	C	
RT+TH+LT	12/1	0.388	0.400	623	677	601	0.888	30.4	*C	490 ft
EB Approach								8.7	A	
RT+TH	12/1	0.273	0.533	952	982	433	0.441	8.9	A	209 ft
LT	12/1	0.250	0.533	913	944	372	0.394	8.5	A	175 ft

Institute for Astronomy
PM Peak Hour of Traffic
Base Year 2006

01/07/04
08:47:34

SIGNAL2000/TEAPAC[Ver 1.11.00] - Summary of Parameter Values

Intersection Parameters for Int # 0 - Old Haleakala Highway/Makawao

METROAREA	NONCBD			
SIMULATION PERIOD	15			
LEVELOFSERVICE	C	S		
NODELOCATION	0	0		
QUEUEMODELS	1	90	25	40

Approach Parameters

APPLABELS	SB	WB	NB	EB
GRADES	0.0	0.0	0.0	0.0
PEDLEVELS	0	0	0	0
BIKEVOLUMES	0	0	0	0
PARKINGSIDES	NONE	NONE	NONE	NONE
PARKVOLUMES	20	20	20	20
BUSVOLUMES	0	0	0	0
RIGHTTURNONREDS	0	0	0	0
UPSTREAMVC	0.00	0.00	0.00	0.00

Movement Parameters

MOVLABELS	RT	TH	LT	RT	TH	LT	RT	TH	LT	RT	TH	LT
VOLUMES	360	55	55	70	420	50	35	60	20	30	360	335
WIDTHS	12.0	12.0	0.0	0.0	12.0	0.0	0.0	12.0	0.0	0.0	12.0	12.0
LANES	1	1	0	0	1	0	0	1	0	0	1	1
GROUPTYPES	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM
UTILIZATIONS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRUCKPERCENTS	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
PEAKHOURFACTORS	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
ARRIVALTYPES	3	3	3	3	3	3	3	3	3	3	3	3
ACTUATIONS	NO	YES	YES	NO	YES	YES	NO	YES	YES	NO	YES	YES
REQCLEARANCES	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
MINIMUMS	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
STARTUPLOST	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
ENDGAIN	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
STORAGE	0	0	0	0	0	0	0	0	0	0	0	0
INITIALQUEUE	0	0	0	0	0	0	0	0	0	0	0	0
IDEALSATFLOWS	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
FACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
DELAYFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
NSTOPFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
SATURATIONFLOWS	1583	1501	0	0	1694	0	0	1684	0	0	1841	1770

Institute for Astronomy
PM Peak Hour of Traffic
Base Year 2006

01/07/04
08:47:34

SIGNAL2000/TEAPAC[Ver 1.11.00] - Summary of Parameter Values

Phasing Parameters

SEQUENCES	0	0					
PERMISSIVES	NO	NO	NO	NO			
OVERLAPS	YES	YES	YES	YES			
CYCLES	60	120	10				
GREENTIMES	18.00	3.00	24.00				
YELLOWTIMES	5.00	5.00	5.00				
CRITICALS	2	6	5				
EXCESS	0						
PHASEMOVEMENTS	1	1	2	3	7	8	9
PHASEMOVEMENTS	2	10	11	12	0	0	0
PHASEMOVEMENTS	3	4	5	6	10	11	12
PHASEMOVEMENTS	4	0	0	0	0	0	0
PHASEMOVEMENTS	5	0	0	0	0	0	0
PHASEMOVEMENTS	6	0	0	0	0	0	0

LEADLAGS	NONE	NONE
OFFSET	0.00	1
PEDTIME	0.0	0

CHAPTER 17 - TWSC - UNSIGNALIZED INTERSECTIONS WORKSHEET

Analysis Summary

General Information / **Site Information**

Analyst	TL	Jurisdiction/Date	KULA, MAUI 1/7/2004
Agency or Company	ATA	Major Street	KULA HWY
Analysis Period/Year	AM PEAK HOUR 2006	Minor Street	KKHS DRWY
Comment	BASE YEAR 2006		

Input Data

Lane Configuration	SB	NB	EB	WB
Lane 1 (curb)	TR	R	LTR	R
Lane 2	L	LT		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)	230	905	5	5	1160	130	5	0	5	20		125
PHF	.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
Flow rate	256	1006	6	6	1289	144	6	0	6	22		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
EB	1	LTR	13	3	4.162	3	3501.8	F	3501.8
	2								
	3								F
WB	1	R	125	199	.628	4	49.5	E	383.9
	2	L	22	6	3.554	4	2283.9	F	
	3								F
		1	256	471	.543	3	21.4	C	
		4	6	682	.008	<1	10.3	B	

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CHAPTER 17 - TWSC - UNSIGNALIZED INTERSECTIONS WORKSHEET

Analysis Summary

General Information / **Site Information**

Analyst	TL	Jurisdiction/Date	KULA, MAUI 1/7/2004
Agency or Company	ATA	Major Street	KULA HWY
Analysis Period/Year	PM PEAK HOUR 2006	Minor Street	KKHS DRWY
Comment	BASE YEAR 2006		

Input Data

Lane Configuration	SB	NB	EB	WB
Lane 1 (curb)	TR	R	LTR	R
Lane 2	L	LT		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)	20	1105	5	5	1235	5	5	0	5	10		30
PHF	.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
Flow rate	22	1228	6	6	1372	6	6	0	6	11		33
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
EB	1	LTR	13	21	.624	2	329.2	F	329.2
	2								
	3								F
WB	1	R	33	178	.186	1	29.8	D	158.5
	2	L	11	14	.814	2	544.7	F	
	3								F
		1	22	494	.045	<1	12.6	B	
		4	6	561	.01	<1	11.5	B	

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Institute for Astronomy
Base Year 2006
AM Peak Hour of Traffic

01/07/04
08:29:20

SIGNAL2000/TEAPAC[Ver 1.11.00] - Capacity Analysis Summary

Intersection Averages for Int # 0 - Kula Hwy/A'Apueo Pkwy
Degree of Saturation (v/c) 0.66 Vehicle Delay 22.5 Level of Service C+

```
        --------------------------
Sq 11 |  Phase 1  |  Phase 2  |
**/** --------------------------
      | + +       | +         |
  .   | + +       | +         |
 /|\  |<+ +       |<+         |
  |   |   v       |    ^      |
  |   |       ^   |****       |
North |    <+ *   |           |
  |   |     + *   |++++       |
      |     + *   |  v        |
        --------------------------
      | G/C=0.578 | G/C=0.311 |
      | G= 52.0"  | G= 28.0"  |
      | Y+R= 5.0" | Y+R= 5.0" |
      | OFF= 0.0% | OFF=63.3% |
        --------------------------
      C= 90 sec   G= 80.0 sec = 88.9%  Y=10.0 sec = 11.1%  Ped= 0.0 sec =  0.0%
```

Lane Group	Width/ Lanes	g/C Reqd	g/C Used	Service Rate @C (vph)	Service Rate @E	Adj Volume	v/c	HCM Delay	L S	Queue Model 1
SB Approach								7.8	A	
RT	12/1	0.424	1.000	1583	1583	528	0.334	0.6	A	38 ft
TH	12/1	0.350	0.578	985	1076	511	0.475	15.3	B	426 ft
NB Approach								30.9	C	
TH	12/1	0.574	0.578	1025	1076	1017	0.945	33.7	*C	1138 ft
LT	12/1	0.329	0.578	321	370	144	0.389	11.0	B+	98 ft
EB Approach								33.1	C	
RT	12/1	0.179	0.311	342	493	89	0.181	23.4	C+	83 ft
LT	12/1	0.312	0.311	428	551	428	0.777	35.1	*D+	463 ft

Institute for Astronomy
Base Year 2006
AM Peak Hour of Traffic

01/07/04
08:29:35

SIGNAL2000/TEAPAC[Ver 1.11.00] - Summary of Parameter Values

Intersection Parameters for Int # 0 - Kula Hwy/A'Apueo Pkwy

METROAREA	NONCBD			
SIMULATION PERIOD	15			
LEVELOFSERVICE	C	S		
NODELOCATION	0	0		
QUEUEMODELS	1	90	25	40

Approach Parameters

APPLABELS	SB	WB	NB	EB
GRADES	0.0	0.0	0.0	0.0
PEDLEVELS	0	0	0	0
BIKEVOLUMES	0	0	0	0
PARKINGSIDES	NONE	NONE	NONE	NONE
PARKVOLUMES	20	20	20	20
BUSVOLUMES	0	0	0	0
RIGHTTURNONREDS	0	0	0	0
UPSTREAMVC	0.00	0.00	0.00	0.00

Movement Parameters

MOVLABELS	RT	TH	LT	RT	TH	LT	RT	TH	LT	RT	TH	LT
VOLUMES	475	460	0	0	0	0	0	915	130	80	0	385
WIDTHS	12.0	12.0	0.0	0.0	0.0	0.0	0.0	12.0	12.0	12.0	0.0	12.0
LANES	1	1	0	0	0	0	0	1	1	1	0	1
GROUPTYPES	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM
UTILIZATIONS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRUCKPERCENTS	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
PEAKHOURFACTORS	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
ARRIVALTYPES	2	2	2	3	3	3	3	3	3	3	3	3
ACTUATIONS	NO	YES	YES	NO	YES	YES	NO	YES	YES	NO	YES	YES
REQCLEARANCES	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
MINIMUMS	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
STARTUPLOST	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
ENDGAIN	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
STORAGE	0	0	0	0	0	0	0	0	0	0	0	0
INITIALQUEUE	0	0	0	0	0	0	0	0	0	0	0	0
IDEALSATFLOWS	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
FACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
DELAYFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
NSTOPFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
SATURATIONFLOWS	1583	1863	0	0	0	0	0	1863	641	1583	0	1770

Phasing Parameters

SEQUENCES	11	11					
PERMISSIVES	NO	NO	NO	NO	LEADLAGS	NONE	NONE
OVERLAPS	YES	YES	YES	YES	OFFSET	0.00	1
CYCLES	90	90	10		PEDTIME	0.0	0
GREENTIMES	52.00	28.00					
YELLOWTIMES	5.00	5.00					
CRITICALS	8	12					
EXCESS	0						

```
Institute for Astronomy                                                01/07/04
Base Year 2006                                                         08:30:15
PM Peak Hour of Traffic

SIGNAL2000/TEAPAC[Ver 1.11.00] - Capacity Analysis Summary

Intersection Averages for Int #   0 - Kula Hwy/A'Apueo Pkwy
     Degree of Saturation (v/c) 0.77  Vehicle Delay  33.4   Level of Service C

          -------------------------
Sq 11 |   Phase 1   |   Phase 2   |
**/** -------------------------
      | + *         | +           |
  .   | + *         | +           |
 /|\  |<+ *         |<+           |
  |   |   v         |    ^        |
  |   |        ^    |****         |
North |     <+ +    |             |
  |   |       + +   |++++         |
      |       + +   |    v        |
          -------------------------
      | G/C=0.456 | G/C=0.433 |
      | G=  41.0" | G=  39.0" |
      | Y+R= 5.0" | Y+R= 5.0" |
      | OFF= 0.0% | OFF=51.1% |
          -------------------------
     C= 90 sec    G= 80.0 sec = 88.9%  Y=10.0 sec = 11.1%  Ped= 0.0 sec =  0.0%

-------------------------------------------------------------------------------
| Lane    |Width/|     g/C      | Service Rate|  Adj |        |  HCM  | L | Queue |
|  Group  | Lanes| Reqd   Used  | @C (vph) @E |Volume|  v/c   | Delay | S |Model 1|
-------------------------------------------------------------------------------

SB Approach                                                  31.4   C
===============================================================================
|   RT    | 12/1 |0.367 |1.000 | 1583 | 1583 |  422 |0.267 |   0.4 | A |  28 ft|
|   TH    | 12/1 |0.492 |0.456 |  731 |  849 |  806 |0.949 |  47.6 |*D | 972 ft|
-------------------------------------------------------------------------------

NB Approach                                                  28.6   C
===============================================================================
|   TH    | 12/1 |0.406 |0.456 |  763 |  849 |  656 |0.773 |  25.0 | C+| 630 ft|
|   LT    | 12/1 |0.531 |0.456 |   54 |   73 |   67 |0.807 |  63.7 | E+|  87 ft|
-------------------------------------------------------------------------------

EB Approach                                                  40.4   D+
===============================================================================
|   RT    | 12/1 |0.189 |0.433 |  580 |  686 |  106 |0.155 |  16.0 | B |  83 ft|
|   LT    | 12/1 |0.456 |0.433 |  676 |  767 |  722 |0.941 |  44.0 |*D+| 863 ft|
-------------------------------------------------------------------------------
```

```
Institute for Astronomy                                                01/07/04
Base Year 2006                                                         08:30:35
PM Peak Hour of Traffic

SIGNAL2000/TEAPAC[Ver 1.11.00] - Summary of Parameter Values

   Intersection Parameters for Int #   0 - Kula Hwy/A'Apueo Pkwy
METROAREA            NONCBD
SIMULATION PERIOD        15
LEVELOFSERVICE       C    S
NODELOCATION         0    0
QUEUEMODELS    1  90  25  40

   Approach Parameters
APPLABELS             SB              WB              NB              EB
GRADES               0.0             0.0             0.0             0.0
PEDLEVELS              0               0               0               0
BIKEVOLUMES            0               0               0               0
PARKINGSIDES        NONE            NONE            NONE            NONE
PARKVOLUMES           20              20              20              20
BUSVOLUMES             0               0               0               0
RIGHTTURNONREDS        0               0               0               0
UPSTREAMVC          0.00            0.00            0.00            0.00

   Movement Parameters
MOVLABELS          RT   TH   LT    RT   TH   LT    RT   TH   LT    RT   TH   LT
VOLUMES           380  725    0     0    0    0     0  590   60    95    0  650
WIDTHS           12.0 12.0  0.0   0.0  0.0  0.0   0.0 12.0 12.0  12.0  0.0 12.0
LANES               1    1    0     0    0    0     0    1    1     1    0    1
GROUPTYPES       NORM NORM NORM  NORM NORM NORM  NORM NORM NORM  NORM NORM NORM
UTILIZATIONS     0.00 0.00 0.00  0.00 0.00 0.00  0.00 0.00 0.00  0.00 0.00 0.00
TRUCKPERCENTS     2.0  2.0  2.0   2.0  2.0  2.0   2.0  2.0  2.0   2.0  2.0  2.0
PEAKHOURFACTORS  0.90 0.90 0.90  0.90 0.90 0.90  0.90 0.90 0.90  0.90 0.90 0.90
ARRIVALTYPES        2    2    2     3    3    3     3    3    3     3    3    3
ACTUATIONS         NO  YES  YES    NO  YES  YES    NO  YES  YES    NO  YES  YES
REQCLEARANCES     5.0  5.0  5.0   5.0  5.0  5.0   5.0  5.0  5.0   5.0  5.0  5.0
MINIMUMS          5.0  5.0  5.0   5.0  5.0  5.0   5.0  5.0  5.0   5.0  5.0  5.0
STARTUPLOST       2.0  2.0  2.0   2.0  2.0  2.0   2.0  2.0  2.0   2.0  2.0  2.0
ENDGAIN           2.0  2.0  2.0   2.0  2.0  2.0   2.0  2.0  2.0   2.0  2.0  2.0
STORAGE             0    0    0     0    0    0     0    0    0     0    0    0
INITIALQUEUE        0    0    0     0    0    0     0    0    0     0    0    0
IDEALSATFLOWS    1900 1900 1900  1900 1900 1900  1900 1900 1900  1900 1900 1900
FACTORS          1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00
DELAYFACTORS     1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00
NSTOPFACTORS     1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00
SATURATIONFLOWS  1583 1863    0     0    0    0     0 1863  182  1583    0 1770

   Phasing Parameters
SEQUENCES          11     11
PERMISSIVES        NO     NO     NO     NO        LEADLAGS      NONE   NONE
OVERLAPS          YES    YES    YES    YES        OFFSET        0.00      1
CYCLES             90    180     90               PEDTIME        0.0      0
GREENTIMES      41.00  39.00
YELLOWTIMES      5.00   5.00
CRITICALS           2     12
EXCESS              0
```

ATA Austin, Tsutsumi & Associates, Inc.
Civil Engineers • Surveyors

APPENDIX C

LEVEL OF SERVICE CALCULATIONS

- Base Year 2006 with Mitigative Measures

Institute for Astronomy
AM Peak Hour of Traffic
Base Year 2006 with traffic signal and Halekala Highway widen

01/07/04
11:57:05

SIGNAL2000/TEAPAC[Ver 1.11.00] - Capacity Analysis Summary

Intersection Averages for Int # 0 - Haleakala Highway/Old Haleakal
Degree of Saturation (v/c) 0.90 Vehicle Delay 75.0 Level of Service E

```
       -----------------------
Sq 11 | Phase 1  | Phase 2  |
**/** -----------------------
      |          |          |
 /|\  |          |     <****|
  |   |          |          |
  |   |          |          |
North |    <*    |++++>     |
  |   |     *    |          |
      |     *    |          |
       -----------------------
      | G/C=0.522 | G/C=0.422 |
      | G=  94.0" | G=  76.0" |
      | Y+R= 5.0" | Y+R= 5.0" |
      | OFF= 0.0% | OFF=55.0% |
       -----------------------
   C=180 sec   G=170.0 sec = 94.4%  Y=10.0 sec =  5.6%  Ped= 0.0 sec =  0.0%
```

Lane Group	Width/ Lanes	g/C Reqd	g/C Used	Service Rate @C (vph)	Service Rate @E	Adj Volume	v/c	HCM Delay	L S	Queue Model 1
NB Approach								75.0	E	
LT	12/1	0.616	0.522	652	924	933	1.010	75.0	*E	2087 ft
WB Approach								86.3	F	
TH	24/2	0.609	0.422	26	1477	1511	1.011	86.3	*F	1807 ft
EB Approach								34.2	C	
TH	24/2	0.415	0.422	490	1494	417	0.279	34.2	C	319 ft

Institute for Astronomy
AM Peak Hour of Traffic
Base Year 2006 with traffic signal and Halekala Highway widen

01/07/04
11:57:12

SIGNAL2000/TEAPAC[Ver 1.11.00] - Summary of Parameter Values

Intersection Parameters for Int # 0 - Haleakala Highway/Old Haleakal

METROAREA	NONCBD			
SIMULATION PERIOD	15			
LEVELOFSERVICE	C	8		
NODELOCATION	0	0		
QUEUEMODELS	1	90	25	40

Approach Parameters

APPLABELS	SB	WB	NB	EB
GRADES	0.0	0.0	0.0	0.0
PEDLEVELS	0	0	0	0
BIKEVOLUMES	0	0	0	0
PARKINGSIDES	NONE	NONE	NONE	NONE
PARKVOLUMES	20	20	20	20
BUSVOLUMES	0	0	0	0
RIGHTTURNONREDS	0	0	0	0
UPSTREAMVC	0.00	0.00	0.00	0.00

Movement Parameters

MOVLABELS	RT	TH	LT	RT	TH	LT	RT	TH	LT	RT	TH	LT
VOLUMES	0	0	0	0	1360	0	5	0	840	285	375	0
WIDTHS	0.0	0.0	0.0	0.0	24.0	0.0	12.0	0.0	12.0	12.0	24.0	0.0
LANES	0	0	0	0	2	0	1	0	1	1	2	0
GROUPTYPES	NORM	NORM	NORM	NORM	NORM	NORM	FFLW	NORM	NORM	FFLW	NORM	NORM
UTILIZATIONS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRUCKPERCENTS	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
PEAKHOURFACTORS	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
ARRIVALTYPES	3	3	3	2	2	2	3	3	3	3	3	3
ACTUATIONS	NO	YES	YES	NO	YES	YES	NO	YES	YES	NO	YES	YES
REQCLEARANCES	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
MINIMUMS	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
STARTUPLOST	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
ENDGAIN	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
STORAGE	0	0	0	0	0	0	0	0	0	0	0	0
INITIALQUEUE	0	0	0	0	0	0	0	0	0	0	0	0
IDEALSATFLOWS	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
FACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
DELAYFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
NSTOPFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
SATURATIONFLOWS	0	0	0	0	3539	0	0	0	1770	0	3539	0

Phasing Parameters

SEQUENCES	11	11					
PERMISSIVES	YES	YES	YES	YES	LEADLAGS	NONE	NONE
OVERLAPS	YES	YES	YES	YES	OFFSET	0.00	1
CYCLES	180	180	10		PEDTIME	0.0	0
GREENTIMES	94.00	76.00					
YELLOWTIMES	5.00	5.00					
CRITICALS	9	5					
EXCESS	0						

```
Institute for Astronomy                                            01/07/04
PM Peak Hour of Traffic                                            15:53:01
Base Year 2006 with traffic signal and Halekala Highway widen

SIGNAL2000/TEAPAC[Ver 1.11.00] - Capacity Analysis Summary

Intersection Averages for Int #   0 - Haleakala Highway/Old Haleakal
    Degree of Saturation (v/c) 0.65  Vehicle Delay  14.9  Level of Service B+

        --------------------------
Sq 11 |  Phase 1  |  Phase 2 . |
**/** --------------------------
      |           |            |
 /|\  |           |       <++++|
  |   |           |            |
  |   |           |            |
North |    <*     |****>       |
  |   |     *     |            |
      |     *     |            |
        --------------------------
      | G/C=0.367 | G/C=0.467 |
      | G= 22.0"  | G= 28.0"  |
      | Y+R= 5.0" | Y+R= 5.0" |
      | OFF= 0.0% | OFF=45.0% |
        --------------------------
      C= 60 sec   G= 50.0 sec = 83.3%  Y=10.0 sec = 16.7%  Ped= 0.0 sec =  0.0%

-----------------------------------------------------------------------------
| Lane  |Width/|     g/C     | Service Rate|  Adj  |       |  HCM  | L | Queue |
| Group | Lanes| Reqd   Used | @C (vph) @E |Volume|  v/c  | Delay | S |Model 1|
-----------------------------------------------------------------------------

NB Approach                                                 17.9    B
=============================================================================
|  LT   | 12/1 |0.274 |0.367 |  591  |  649 |  417 |0.643 |  17.9 |*B | 277 ft|
-----------------------------------------------------------------------------

WB Approach                                                 14.3    B+
=============================================================================
|  TH   | 24/2 |0.285 |0.467 | 1608  | 1652 |  928 |0.562 |  14.3 | B+| 315 ft|
-----------------------------------------------------------------------------

EB Approach                                                 14.3    B+
=============================================================================
|  TH   | 24/2 |0.349 |0.467 | 1632  | 1652 | 1178 |0.713 |  14.3 |*B+| 394 ft|
-----------------------------------------------------------------------------
```

```
Institute for Astronomy                                                 01/07/04
PM Peak Hour of Traffic                                                 15:53:09
Base Year 2006 with traffic signal and Halekala Highway widen

SIGNAL2000/TEAPAC[Ver 1.11.00] - Summary of Parameter Values

   Intersection Parameters for Int #   0 - Haleakala Highway/Old Haleakal
METROAREA            NONCBD
SIMULATION PERIOD        15
LEVELOFSERVICE        C   S
NODELOCATION          0   0
QUEUEMODELS      1  90  25  40

   Approach Parameters
APPLABELS               SB             WB             NB             EB
GRADES                 0.0            0.0            0.0            0.0
PEDLEVELS                0              0              0              0
BIKEVOLUMES              0              0              0              0
PARKINGSIDES          NONE           NONE           NONE           NONE
PARKVOLUMES             20             20             20             20
BUSVOLUMES               0              0              0              0
RIGHTTURNONREDS          0              0              0              0
UPSTREAMVC            0.00           0.00           0.00           0.00

   Movement Parameters
MOVLABELS           RT   TH   LT     RT   TH   LT     RT   TH   LT     RT   TH   LT
VOLUMES              0    0    0      0  835    0      5    0  375    690 1060    0
WIDTHS             0.0  0.0  0.0    0.0 24.0  0.0   12.0  0.0 12.0   12.0 24.0  0.0
LANES                0    0    0      0    2    0      1    0    1      1    2    0
GROUPTYPES        NORM NORM NORM   NORM NORM NORM   FFLW NORM NORM   FFLW NORM NORM
UTILIZATIONS      0.00 0.00 0.00   0.00 0.00 0.00   0.00 0.00 0.00   0.00 0.00 0.00
TRUCKPERCENTS      2.0  2.0  2.0    2.0  2.0  2.0    2.0  2.0  2.0    2.0  2.0  2.0
PEAKHOURFACTORS   0.90 0.90 0.90   0.90 0.90 0.90   0.90 0.90 0.90   0.90 0.90 0.90
ARRIVALTYPES         3    3    3      2    2    2      3    3    3      3    3    3
ACTUATIONS          NO  YES  YES     NO  YES  YES     NO  YES  YES     NO  YES  YES
REQCLEARANCES      5.0  5.0  5.0    5.0  5.0  5.0    5.0  5.0  5.0    5.0  5.0  5.0
MINIMUMS           5.0  5.0  5.0    5.0  5.0  5.0    5.0  5.0  5.0    5.0  5.0  5.0
STARTUPLOST        2.0  2.0  2.0    2.0  2.0  2.0    2.0  2.0  2.0    2.0  2.0  2.0
ENDGAIN            2.0  2.0  2.0    2.0  2.0  2.0    2.0  2.0  2.0    2.0  2.0  2.0
STORAGE              0    0    0      0    0    0      0    0    0      0    0    0
INITIALQUEUE         0    0    0      0    0    0      0    0    0      0    0    0
IDEALSATFLOWS     1900 1900 1900   1900 1900 1900   1900 1900 1900   1900 1900 1900
FACTORS           1.00 1.00 1.00   1.00 1.00 1.00   1.00 1.00 1.00   1.00 1.00 1.00
DELAYFACTORS      1.00 1.00 1.00   1.00 1.00 1.00   1.00 1.00 1.00   1.00 1.00 1.00
NSTOPFACTORS      1.00 1.00 1.00   1.00 1.00 1.00   1.00 1.00 1.00   1.00 1.00 1.00
SATURATIONFLOWS      0    0    0      0 3539    0      0    0 1770      0 3539    0

   Phasing Parameters
SEQUENCES           11    11
PERMISSIVES        YES   YES   YES   YES        LEADLAGS     NONE   NONE
OVERLAPS           YES   YES   YES   YES        OFFSET       0.00      1
CYCLES              60   180    60              PEDTIME       0.0      0
GREENTIMES       22.00 28.00
YELLOWTIMES       5.00  5.00
CRITICALS            9    11
EXCESS               0
```

```
Institute for Astronomy                                                  01/07/04
AM Peak Hour of Traffic                                                  13:00:58
Base Year 2006 with traffic signal and Haleakala Highway wide

SIGNAL2000/TEAPAC[Ver 1.11.00] - Capacity Analysis Summary

Intersection Averages for Int #   0 - Haleakala Highway/Old Haleakal
      Degree of Saturation (v/c) 0.56  Vehicle Delay   8.8   Level of Service A

        -------------------------
Sq  0 |  Phase 1  |  Phase 2  |
**/** -------------------------
      |           |           |
  .   |           |           |
 /|\  |     <++++|     <****|
  |   |           |           |
  |   |           |           |
North |    <*     |++++>      |
  |   |     *     |           |
      |     *     |           |
        -------------------------
      | G/C=0.711 | G/C=0.178 |
      | G=  64.0" | G=  16.0" |
      | Y+R= 5.0" | Y+R= 5.0" |
      | OFF= 0.0% | OFF=76.7% |
        -------------------------
      C= 90 sec    G= 80.0 sec = 88.9%  Y=10.0 sec = 11.1%  Ped= 0.0 sec =  0.0%

------------------------------------------------------------------------------
| Lane   |Width/|     g/C     | Service Rate| Adj  |       |  HCM  | L | Queue |
| Group  | Lanes| Reqd   Used | @C (vph) @E |Volume|  v/c  | Delay | S |Model 1|
------------------------------------------------------------------------------

NB Approach                                                  10.3   B+
==============================================================================
|   LT    | 12/1 |0.560 |0.711 | 1243 | 1258 |  933 |0.742 |  10.3 |*B+| 655 ft|
------------------------------------------------------------------------------

WB Approach                                                   0.1   A
==============================================================================
|   TH    | 24/2 |0.467 |1.000 | 3539 | 3539 | 1511 |0.427 |   0.1 |*A |  34 ft|
------------------------------------------------------------------------------

EB Approach                                                  37.1   D+
==============================================================================
|   TH    | 24/2 |0.192 |0.178 |  356 |  629 |  417 |0.663 |  37.1 | D+| 249 ft|
------------------------------------------------------------------------------
```

Institute for Astronomy 01/07/04
AM Peak Hour of Traffic 13:01:09
Base Year 2006 with traffic signal and Haleakala Highway wide

SIGNAL2000/TEAPAC[Ver 1.11.00] - Summary of Parameter Values

Intersection Parameters for Int # 0 - Haleakala Highway/Old Haleakal

METROAREA	NONCBD			
SIMULATION PERIOD	15			
LEVELOFSERVICE	C	S		
NODELOCATION	0	0		
QUEUEMODELS	1	90	25	40

Approach Parameters

APPLABELS	SB	WB	NB	EB
GRADES	0.0	0.0	0.0	0.0
PEDLEVELS	0	0	0	0
BIKEVOLUMES	0	0	0	0
PARKINGSIDES	NONE	NONE	NONE	NONE
PARKVOLUMES	20	20	20	20
BUSVOLUMES	0	0	0	0
RIGHTTURNONREDS	0	0	0	0
UPSTREAMVC	0.00	0.00	0.00	0.00

Movement Parameters

MOVLABELS	RT	TH	LT	RT	TH	LT	RT	TH	LT	RT	TH	LT
VOLUMES	0	0	0	0	1360	0	5	0	840	285	375	0
WIDTHS	0.0	0.0	0.0	0.0	24.0	0.0	12.0	0.0	12.0	12.0	24.0	0.0
LANES	0	0	0	0	2	0	1	0	1	1	2	0
GROUPTYPES	NORM	NORM	NORM	NORM	NORM	NORM	FFLW	NORM	NORM	FFLW	NORM	NORM
UTILIZATIONS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRUCKPERCENTS	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
PEAKHOURFACTORS	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
ARRIVALTYPES	3	3	3	2	2	2	3	3	3	3	3	3
ACTUATIONS	NO	YES	YES	NO	YES	YES	NO	YES	YES	NO	YES	YES
REQCLEARANCES	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
MINIMUMS	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
STARTUPLOST	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
ENDGAIN	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
STORAGE	0	0	0	0	0	0	0	0	0	0	0	0
INITIALQUEUE	0	0	0	0	0	0	0	0	0	0	0	0
IDEALSATFLOWS	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
FACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
DELAYFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
NSTOPFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
SATURATIONFLOWS	0	0	0	0	3539	0	0	0	1770	0	3539	0

Institute for Astronomy
AM Peak Hour of Traffic
Base Year 2006 with traffic signal and Haleakala Highway wide

01/07/04
13:01:09

SIGNAL2000/TEAPAC[Ver 1.11.00] - Summary of Parameter Values

```
  Phasing Parameters
SEQUENCES           0      0
PERMISSIVES       YES    YES    YES    YES          LEADLAGS      NONE    NONE
OVERLAPS          YES    YES    YES    YES          OFFSET        0.00       1
CYCLES             60    180     10                 PEDTIME        0.0       0
GREENTIMES      64.00  16.00
YELLOWTIMES      5.00   5.00
CRITICALS           9      5
EXCESS              0
PHASEMOVEMENTS      1      9      5      0      0      0      0
PHASEMOVEMENTS      2      5     11      0      0      0      0
PHASEMOVEMENTS      3      0      0      0      0      0      0
PHASEMOVEMENTS      4      0      0      0      0      0      0
PHASEMOVEMENTS      5      0      0      0      0      0      0
PHASEMOVEMENTS      6      0      0      0      0      0      0
```

Institute for Astronomy
PM Peak Hour of Traffic
Base Year 2006 with traffic signal and Haleakala Highway wide

01/07/04
15:51:48

SIGNAL2000/TEAPAC[Ver 1.11.00] - Capacity Analysis Summary

Intersection Averages for Int # 0 - Haleakala Highway/Old Haleakal
Degree of Saturation (v/c) 0.52 Vehicle Delay 9.2 Level of Service A

```
        ---------------------------
Sq  0 |  Phase 1  |  Phase 2  |
**/** ---------------------------
      |           |           |
 /|\  |     <++++|      <****|
  |   |           |           |
North |    <*     |++++>      |
  |   |     *     |           |
      |     *     |           |
        ---------------------------
      | G/C=0.333 | G/C=0.500 |
      | G= 20.0"  | G= 30.0"  |
      | Y+R= 5.0" | Y+R= 5.0" |
      | OFF= 0.0% | OFF=41.7% |
        ---------------------------
       C= 60 sec   G= 50.0 sec = 83.3%  Y=10.0 sec = 16.7%  Ped= 0.0 sec =  0.0%
```

Lane Group	Width/ Lanes	g/C Reqd	g/C Used	Service Rate @C (vph)	Service Rate @E	Adj Volume	v/c	HCM Delay	L S	Queue Model 1
NB Approach								21.3	C+	
LT	12/1	0.274	0.333	528	590	417	0.707	21.3	*C+	297 ft
WB Approach								0.0	A	
TH	24/2	0.285	1.000	3539	3539	928	0.262	0.0	*A	13 ft
EB Approach								12.2	B+	
TH	24/2	0.349	0.500	1761	1770	1178	0.666	12.2	B+	367 ft

```
Institute for Astronomy                                                01/07/04
PM Peak Hour of Traffic                                                15:52:03
Base Year 2006 with traffic signal and Haleakala Highway wide

SIGNAL2000/TEAPAC[Ver 1.11.00] - Summary of Parameter Values

  Intersection Parameters for Int #   0 - Haleakala Highway/Old Haleakal
METROAREA           NONCBD
SIMULATION PERIOD       15
LEVELOFSERVICE       C   S
NODELOCATION         0   0
QUEUEMODELS     1  90  25  40

  Approach Parameters
APPLABELS             SB            WB            NB            EB
GRADES               0.0           0.0           0.0           0.0
PEDLEVELS              0             0             0             0
BIKEVOLUMES            0             0             0             0
PARKINGSIDES        NONE          NONE          NONE          NONE
PARKVOLUMES           20            20            20            20
BUSVOLUMES             0             0             0             0
RIGHTTURNONREDS        0             0             0             0
UPSTREAMVC          0.00          0.00          0.00          0.00

  Movement Parameters
MOVLABELS          RT   TH   LT    RT   TH   LT    RT   TH   LT    RT   TH   LT
VOLUMES             0    0    0     0  835    0     5    0  375   690 1060    0
WIDTHS            0.0  0.0  0.0   0.0 24.0  0.0  12.0  0.0 12.0  12.0 24.0  0.0
LANES               0    0    0     0    2    0     1    0    1     1    2    0
GROUPTYPES       NORM NORM NORM  NORM NORM NORM  FFLW NORM NORM  FFLW NORM NORM
UTILIZATIONS     0.00 0.00 0.00  0.00 0.00 0.00  0.00 0.00 0.00  0.00 0.00 0.00
TRUCKPERCENTS     2.0  2.0  2.0   2.0  2.0  2.0   2.0  2.0  2.0   2.0  2.0  2.0
PEAKHOURFACTORS  0.90 0.90 0.90  0.90 0.90 0.90  0.90 0.90 0.90  0.90 0.90 0.90
ARRIVALTYPES        3    3    3     2    2    2     3    3    3     3    3    3
ACTUATIONS         NO  YES  YES    NO  YES  YES    NO  YES  YES    NO  YES  YES
REQCLEARANCES     5.0  5.0  5.0   5.0  5.0  5.0   5.0  5.0  5.0   5.0  5.0  5.0
MINIMUMS          5.0  5.0  5.0   5.0  5.0  5.0   5.0  5.0  5.0   5.0  5.0  5.0
STARTUPLOST       2.0  2.0  2.0   2.0  2.0  2.0   2.0  2.0  2.0   2.0  2.0  2.0
ENDGAIN           2.0  2.0  2.0   2.0  2.0  2.0   2.0  2.0  2.0   2.0  2.0  2.0
STORAGE             0    0    0     0    0    0     0    0    0     0    0    0
INITIALQUEUE        0    0    0     0    0    0     0    0    0     0    0    0
IDEALSATFLOWS    1900 1900 1900  1900 1900 1900  1900 1900 1900  1900 1900 1900
FACTORS          1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00
DELAYFACTORS     1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00
NSTOPFACTORS     1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00
SATURATIONFLOWS     0    0    0     0 3539    0     0    0 1770     0 3539    0
```

```
Institute for Astronomy                                                01/07/04
PM Peak Hour of Traffic                                                15:52:03
Base Year 2006 with traffic signal and Haleakala Highway wide

SIGNAL2000/TEAPAC[Ver 1.11.00] - Summary of Parameter Values

  Phasing Parameters
SEQUENCES           0     0
PERMISSIVES       YES   YES   YES   YES           LEADLAGS     NONE   NONE
OVERLAPS          YES   YES   YES   YES           OFFSET       0.00      1
CYCLES             60   180    60                 PEDTIME       0.0      0
GREENTIMES      20.00 30.00
YELLOWTIMES      5.00  5.00
CRITICALS           9     5
EXCESS              0
PHASEMOVEMENTS      1     9     5     0     0     0     0
PHASEMOVEMENTS      2     5    11     0     0     0     0
PHASEMOVEMENTS      3     0     0     0     0     0     0
PHASEMOVEMENTS      4     0     0     0     0     0     0
PHASEMOVEMENTS      5     0     0     0     0     0     0
PHASEMOVEMENTS      6     0     0     0     0     0     0
```

HCS2000: Ramps and Ramp Junctions Release 4.1d

Tara Lucas
ATA
501 Sumner Street
Suite 521
Honolulu, Hawaii 96817
Phone: (808)533-3646 Fax:
E-mail: atahnl@atahawaii.com

Merge Analysis

Analyst:	TL
Agency/Co.:	ATA
Date performed:	1/8/2004
Analysis time period:	AM peak
Freeway/Dir of Travel:	Haleakala Highway/westbound
Junction:	west of HH/OHH western int
Jurisdiction:	Maui
Analysis Year:	Base Year 2006 with widening
Description:	Institute for Astronomy

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	55.0	mph
Volume on freeway	1360	vph

On Ramp Data

Side of freeway	Left	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	840	vph
Length of first accel/decel lane	500	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	1360	840		vph
Peak-hour factor, PHF	0.90	0.90		
Peak 15-min volume, v15	378	233		v
Trucks and buses	0	0		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		
Heavy vehicle adjustment, fHV	1.000	1.000		
Driver population factor, fP	1.00	1.00		
Flow rate, vp	1511	933		pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = 1.000 Using Equation 0

$v_{12} = v_F (P_{FM})$ = 1511 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	2444	4500	No
v_{R12}	2625	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\ v_R + 0.0078\ v_{12} - 0.00627\ L_A$ = 21.0 pc/mi/ln

Level of service for ramp-freeway junction areas of influence C

Speed Estimation

Intermediate speed variable,	M_S = 0.340	
Space mean speed in ramp influence area,	S_R = 50.6	mph
Space mean speed in outer lanes,	S_0 = N/A	mph
Space mean speed for all vehicles,	S = 50.6	mph

HCS2000: Ramps and Ramp Junctions Release 4.1d

Tara Lucas
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501 Sumner Street
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Honolulu, Hawaii 96817
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E-mail: atahnl@atahawaii.com

Merge Analysis

Analyst:	TL
Agency/Co.:	ATA
Date performed:	1/8/2004
Analysis time period:	PM peak
Freeway/Dir of Travel:	Haleakala Highway/westbound
Junction:	west of HH/OHH western int
Jurisdiction:	Maui
Analysis Year:	Base Year 2006 with widening
Description:	Institute for Astronomy

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	55.0	mph
Volume on freeway	835	vph

On Ramp Data

Side of freeway	Left	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	375	vph
Length of first accel/decel lane	500	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	835	375		vph
Peak-hour factor, PHF	0.90	0.90		
Peak 15-min volume, v15	232	104		v
Trucks and buses	0	0		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		
Heavy vehicle adjustment, fHV	1.000	1.000		
Driver population factor, fP	1.00	1.00		
Flow rate, vp	928	417		pcph

Estimation of V12 Merge Areas

$L =$ (Equation 25-2 or 25-3)

$P_{FM}^{EQ} = 1.000$ Using Equation 0

$v_{12} = v_F (P_{FM}) = 928$ pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	1345	4500	No
v_{R12}	1456	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\, v_R + 0.0078\, v_{12} - 0.00627\, L_A = 12.6$ pc/mi/ln

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable,	$M_S = 0.303$	
Space mean speed in ramp influence area,	$S_R = 51.1$	mph
Space mean speed in outer lanes,	$S_0 =$ N/A	mph
Space mean speed for all vehicles,	$S = 51.1$	mph

Institute for Astronomy
AM Peak Hour of Traffic
Base Year 2006 with Halekala Highway widening

01/09/04
17:30:05

SIGNAL2000/TEAPAC[Ver 1.11.00] - Capacity Analysis Summary

Intersection Averages for Int # 0 - Haleakala Highway/Makani Road
Degree of Saturation (v/c) 0.52 Vehicle Delay 21.2 Level of Service C+

```
       -------------------------
Sq 11 |  Phase 1   |  Phase 2  |
**/** -------------------------
      | * + +      |        ^  |
      | * + +      |      ****|
 /|\  |<* + +>     |     <****|
  |   |  v         |    ^  ++++|
  |   |        ^   |++++   v   |
North |    <+ + +> |++++>      |
  |   |     + + +  |++++       |
      |     + + +  |  v        |
       -------------------------
      | G/C=0.422  | G/C=0.467 |
      | G=  38.0"  | G=  42.0" |
      | Y+R= 5.0"  | Y+R= 5.0" |
      | OFF= 0.0%  | OFF=47.8% |
       -------------------------
```

C= 90 sec G= 80.0 sec = 88.9% Y=10.0 sec = 11.1% Ped= 0.0 sec = 0.0%

Lane Group	Width/ Lanes	g/C Reqd	g/C Used	Service Rate @C (vph)	Service Rate @E	Adj Volume	v/c	HCM Delay	L S	Queue Model 1
SB Approach								21.9	C+	
RT	12/1	0.341	0.422	559	669	400	0.598	24.0	*C+	359 ft
TH+LT	12/1	0.250	0.422	518	606	239	0.394	18.4	B	195 ft
NB Approach								16.4	B	
RT	12/1	0.189	0.422	559	669	106	0.158	16.6	B	84 ft
TH+LT	12/1	0.160	0.422	652	746	117	0.157	16.2	B	86 ft
WB Approach								24.2	C+	
RT+TH	24/2	0.380	0.467	1498	1640	1156	0.705	24.3	*C+	598 ft
LT	12/1	0.137	0.467	351	437	22	0.050	15.8	B	18 ft
EB Approach								14.8	B+	
RT+TH	24/2	0.187	0.467	1563	1648	395	0.240	14.5	B+	146 ft
LT	12/1	0.225	0.467	69	91	39	0.386	18.1	B	34 ft

Institute for Astronomy
AM Peak Hour of Traffic
Base Year 2006 with Halekala Highway widening

01/09/04
17:30:27

SIGNAL2000/TEAPAC[Ver 1.11.00] - Summary of Parameter Values

Intersection Parameters for Int # 0 - Haleakala Highway/Makani Road

METROAREA		NONCBD		
SIMULATION PERIOD			15	
LEVELOFSERVICE		C	S	
NODELOCATION		0	0	
QUEUEMODELS	1	90	25	40

Approach Parameters

APPLABELS	SB	WB	NB	EB
GRADES	0.0	0.0	0.0	0.0
PEDLEVELS	0	0	0	0
BIKEVOLUMES	0	0	0	0
PARKINGSIDES	NONE	NONE	NONE	NONE
PARKVOLUMES	20	20	20	20
BUSVOLUMES	0	0	0	0
RIGHTTURNONREDS	0	0	0	0
UPSTREAMVC	0.00	0.00	0.00	0.00

Movement Parameters

MOVLABELS	RT	TH	LT	RT	TH	LT	RT	TH	LT	RT	TH	LT
VOLUMES	360	100	115	50	990	20	95	90	15	5	350	35
WIDTHS	12.0	12.0	0.0	0.0	24.0	12.0	12.0	12.0	0.0	0.0	24.0	12.0
LANES	1	1	0	0	2	1	1	1	0	0	2	1
GROUPTYPES	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM
UTILIZATIONS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRUCKPERCENTS	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
PEAKHOURFACTORS	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
ARRIVALTYPES	3	3	3	2	2	2	3	3	3	3	3	3
ACTUATIONS	NO	YES	YES	NO	YES	YES	NO	YES	YES	NO	YES	YES
REQCLEARANCES	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
MINIMUMS	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
STARTUPLOST	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
ENDGAIN	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
STORAGE	0	0	0	0	0	0	0	0	0	0	0	0
INITIALQUEUE	0	0	0	0	0	0	0	0	0	0	0	0
IDEALSATFLOWS	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
FACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
DELAYFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
NSTOPFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
SATURATIONFLOWS	1583	1434	0	0	3513	937	1583	1767	0	0	3531	217

Phasing Parameters

SEQUENCES	11	11					
PERMISSIVES	NO	NO	NO	NO	LEADLAGS	NONE	NONE
OVERLAPS	YES	YES	YES	YES	OFFSET	0.00	1
CYCLES	90	180	90		PEDTIME	0.0	0
GREENTIMES	38.00	42.00					
YELLOWTIMES	5.00	5.00					
CRITICALS	1	5					
EXCESS	0						

Institute for Astronomy
PM Peak Hour of Traffic
Base Year 2006 with Halekala Highway widening

01/07/04
15:48:07

SIGNAL2000/TEAPAC[Ver 1.11.00] - Capacity Analysis Summary

Intersection Averages for Int # 0 - Haleakala Highway/Makani Road
Degree of Saturation (v/c) 0.39 Vehicle Delay 8.1 Level of Service A

```
Sq 11 |  Phase 1  |  Phase 2  |
**/** -------------------------
      | * + +     |        ^  |
      | * + +     |      ++++|
 /|\  |<* + +>    |     <++++|
  |   |   v       |    ^ ++++|
  |   |       ^   |****   v  |
North |    <+ + +>|++++>      |
  |   |     + + + |++++       |
      |     + + + |   v       |
      -------------------------
      | G/C=0.167 | G/C=0.667 |
      | G=  10.0" | G=  40.0" |
      | Y+R= 5.0" | Y+R= 5.0" |
      | OFF= 0.0% | OFF=25.0% |
      -------------------------
```

C= 60 sec G= 50.0 sec = 83.3% Y=10.0 sec = 16.7% Ped= 0.0 sec = 0.0%

Lane Group	Width/Lanes	g/C Reqd	g/C Used	Service Rate @C (vph)	Service Rate @E	Adj Volume	v/c	HCM Delay	L S	Queue Model 1
SB Approach								24.2	C+	
RT	12/1	0.115	0.167	171	264	94	0.356	25.9	*C+	74 ft
TH+LT	12/1	0.076	0.167	226	296	83	0.280	22.4	C+	59 ft
NB Approach								22.4	C+	
RT	12/1	0.059	0.167	171	264	28	0.106	22.0	C+	22 ft
TH+LT	12/1	0.082	0.167	233	304	95	0.313	22.6	C+	68 ft
WB Approach								7.0	A	
RT+TH	24/2	0.277	0.667	2346	2346	894	0.381	7.0	A	242 ft
LT	12/1	0.000	0.667	296	336	33	0.098	5.7	A	16 ft
EB Approach								5.1	A	
RT+TH	24/2	0.297	0.667	2355	2355	978	0.415	4.7	A	191 ft
LT	12/1	0.440	0.667	308	340	183	0.538	6.9	*A	85 ft

Institute for Astronomy
PM Peak Hour of Traffic
Base Year 2006 with Halekala Highway widening

01/07/04
15:48:21

SIGNAL2000/TEAPAC[Ver 1.11.00] - Summary of Parameter Values

Intersection Parameters for Int # 0 - Haleakala Highway/Makani Road

METROAREA	NONCBD	
SIMULATION PERIOD		15
LEVELOFSERVICE	C	S
NODELOCATION	0	0
QUEUEMODELS	1 90 25	40

Approach Parameters

APPLABELS	SB	WB	NB	EB
GRADES	0.0	0.0	0.0	0.0
PEDLEVELS	0	0	0	0
BIKEVOLUMES	0	0	0	0
PARKINGSIDES	NONE	NONE	NONE	NONE
PARKVOLUMES	20	20	20	20
BUSVOLUMES	0	0	0	0
RIGHTTURNONREDS	0	0	0	0
UPSTREAMVC	0.00	0.00	0.00	0.00

Movement Parameters

MOVLABELS	RT	TH	LT	RT	TH	LT	RT	TH	LT	RT	TH	LT
VOLUMES	85	65	10	30	775	30	25	80	5	10	870	165
WIDTHS	12.0	12.0	0.0	0.0	24.0	12.0	12.0	12.0	0.0	0.0	24.0	12.0
LANES	1	1	0	0	2	1	1	1	0	0	2	1
GROUPTYPES	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM
UTILIZATIONS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRUCKPERCENTS	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
PEAKHOURFACTORS	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
ARRIVALTYPES	3	3	3	2	2	2	3	3	3	3	3	3
ACTUATIONS	NO	YES	YES	NO	YES	YES	NO	YES	YES	NO	YES	YES
REQCLEARANCES	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
MINIMUMS	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
STARTUPLOST	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
ENDGAIN	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
STORAGE	0	0	0	0	0	0	0	0	0	0	0	0
INITIALQUEUE	0	0	0	0	0	0	0	0	0	0	0	0
IDEALSATFLOWS	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
FACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
DELAYFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
NSTOPFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
SATURATIONFLOWS	1583	1775	0	0	3520	505	1583	1825	0	0	3533	511

Phasing Parameters

SEQUENCES	11	11		
PERMISSIVES	NO	NO	NO	NO
OVERLAPS	YES	YES	YES	YES
CYCLES	60	180	60	
GREENTIMES	10.00	40.00		
YELLOWTIMES	5.00	5.00		
CRITICALS	1	12		
EXCESS	0			

LEADLAGS	NONE	NONE
OFFSET	0.00	1
PEDTIME	0.0	0

Institute for Astronomy
AM Peak Hour of Traffic
Base Year 2006 with Halekala Highway widening

01/07/04
15:35:50

SIGNAL2000/TEAPAC[Ver 1.11.00] - Capacity Analysis Summary

Intersection Averages for Int # 0 - Haleakala Highway/Makawao Aven
Degree of Saturation (v/c) 0.62 Vehicle Delay 33.3 Level of Service C

```
      ------------------------------------------------------------------------
Sq 56 | Phase 1  | Phase 2   | Phase 3  | Phase 4    | Phase 5  | Phase 6  |
**/** ------------------------------------------------------------------------
      |    + ^   | + + * ^   | + +      | +          | +        |        ^ |
      |    + ++++| + + * ++++| + +      | +          | +        |     ++++ |
 /|\  |    +>    |<+ + *>    |<+ +      |<+          |<+        |    <**** |
  |   |          |    v      |   v      |    ^  **** |    ^     |          |
  |   |          |           |      ^   |++++   v    |****      |          |
North |    <*    |           |    * +>  |         +> |++++>     |++++>     |
  |   |++++ *    |           |    * +   |         +  |++++      |++++      |
      |   v *    |           |    * +   |         +  |   v      |   v      |
      ------------------------------------------------------------------------
      | G/C=0.067 | G/C=0.111 | G/C=0.111 | G/C=0.067 | G/C=0.044 | G/C=0.267 |
      | G=   6.0" | G=  10.0" | G=  10.0" | G=   6.0" | G=   4.0" | G=  24.0" |
      | Y+R= 5.0" | Y+R= 5.0" | Y+R= 5.0" | Y+R= 5.0" | Y+R= 5.0" | Y+R= 5.0" |
      | OFF= 0.0% | OFF=12.2% | OFF=28.9% | OFF=45.6% | OFF=57.8% | OFF=67.8% |
      ------------------------------------------------------------------------
      C= 90 sec   G= 60.0 sec = 66.7%  Y=30.0 sec = 33.3%  Ped= 0.0 sec =  0.0%
```

Lane Group	Width/ Lanes	g/C Reqd	g/C Used	Service Rate @C (vph)	Service Rate @E	Adj Volume	v/c	HCM Delay	L S	Queue Model 1
SB Approach								30.8	C	
RT	12/1	0.296	0.500	709	792	311	0.393	15.5	B	230 ft
TH	12/1	0.268	0.278	381	517	361	0.698	33.3	C	381 ft
LT	12/1	0.262	0.233	272	413	328	0.794	42.7	*D+	381 ft
NB Approach								45.7	D	
RT	12/1	0.128	0.233	189	368	11	0.030	26.8	C+	11 ft
TH	12/1	0.166	0.111	1	190	144	0.696	48.3	*D	176 ft
LT	12/1	0.132	0.067	1	99	39	0.331	41.7	*D+	46 ft
WB Approach								34.8	C	
RT	12/1	0.301	0.556	774	880	300	0.341	15.5	B	248 ft
TH	24/2	0.295	0.267	710	944	822	0.871	41.8	*D+	525 ft
LT	12/1	0.120	0.067	1	99	6	0.051	39.5	*D+	7 ft
EB Approach								30.8	C	
RT	12/1	0.169	0.489	650	774	72	0.093	15.3	B	64 ft
TH	24/2	0.169	0.367	1111	1298	317	0.244	22.1	C+	155 ft
LT	12/1	0.214	0.167	137	285	228	0.773	47.9	*D	280 ft

Institute for Astronomy
AM Peak Hour of Traffic
Base Year 2006 with Halekala Highway widening

01/07/04
15:36:03

SIGNAL2000/TEAPAC[Ver 1.11.00] - Summary of Parameter Values

Intersection Parameters for Int # 0 - Haleakala Highway/Makawao Aven

METROAREA	NONCBD			
SIMULATION PERIOD	15			
LEVELOFSERVICE	C	S		
NODELOCATION	0	0		
QUEUEMODELS	1	90	25	40

Approach Parameters

APPLABELS	SB	WB	NB	EB
GRADES	0.0	0.0	0.0	0.0
PEDLEVELS	0	0	0	0
BIKEVOLUMES	0	0	0	0
PARKINGSIDES	NONE	NONE	NONE	NONE
PARKVOLUMES	20	20	20	20
BUSVOLUMES	0	0	0	0
RIGHTTURNONREDS	0	0	0	0
UPSTREAMVC	0.00	0.00	0.00	0.00

Movement Parameters

MOVLABELS	RT	TH	LT	RT	TH	LT	RT	TH	LT	RT	TH	LT
VOLUMES	280	325	295	270	740	5	10	130	35	65	285	205
WIDTHS	12.0	12.0	12.0	12.0	24.0	12.0	12.0	12.0	12.0	12.0	24.0	12.0
LANES	1	1	1	1	2	1	1	1	1	1	2	1
GROUPTYPES	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM
UTILIZATIONS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRUCKPERCENTS	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
PEAKHOURFACTORS	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
ARRIVALTYPES	3	3	3	2	2	2	3	3	3	2	2	2
ACTUATIONS	NO	YES	YES	NO	YES	YES	NO	YES	YES	NO	YES	YES
REQCLEARANCES	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
MINIMUMS	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
STARTUPLOST	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
ENDGAIN	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
STORAGE	0	0	0	0	0	0	0	0	0	0	0	0
INITIALQUEUE	0	0	0	0	0	0	0	0	0	0	0	0
IDEALSATFLOWS	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
FACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
DELAYFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
NSTOPFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
SATURATIONFLOWS	1583	1863	1770	1583	3539	1770	1583	1863	1770	1583	3539	1770

Phasing Parameters

SEQUENCES	56	56					LEADLAGS	NONE	NONE
PERMISSIVES	NO	NO	NO	NO			OFFSET	0.00	1
OVERLAPS	YES	YES	YES	YES			PEDTIME	0.0	0
CYCLES	90	180	90						
GREENTIMES	6.00	10.00	10.00	6.00	4.00	24.00			
YELLOWTIMES	5.00	5.00	5.00	5.00	5.00	5.00			
CRITICALS	9	3	8	6	12	5			
EXCESS	0								

Institute for Astronomy
PM Peak Hour of Traffic
Base Year 2006 with Halekala Highway widening

01/07/04
15:46:49

SIGNAL2000/TEAPAC[Ver 1.11.00] - Capacity Analysis Summary

Intersection Averages for Int # 0 - Haleakala Highway/Makawao Aven
Degree of Saturation (v/c) 0.68 Vehicle Delay 49.2 Level of Service D

```
Sq 56 |  Phase 1  |  Phase 2  |  Phase 3  |  Phase 4  |  Phase 5  |  Phase 6  |
**/** -----------------------------------------------------------------------
      |     + ^   | + + * ^   | + +       | +         | +         |        ^  |
      |     + ++++| + + * ++++| + +       | +         | +         |      ++++ |
 /|\  |     +>    |<+ + *>    |<+ +       |<+         |<+         |     <**** |
  |   |           |     v     |   v       |    ^  ****|    ^      |           |
  |   |           |           |       ^   |++++   v   |****       |           |
North |    <*     |           |       * +>|        +> |++++>      |++++>      |
  |   |++++ *     |           |       * + |        +  |++++       |++++       |
      |   v *     |           |       * + |        +  |   v       |   v       |
      -----------------------------------------------------------------------
      | G/C=0.075 | G/C=0.017 | G/C=0.350 | G/C=0.042 | G/C=0.075 | G/C=0.192 |
      | G=   9.0" | G=   2.0" | G=  42.0" | G=   5.0" | G=   9.0" | G=  23.0" |
      | Y+R= 5.0" | Y+R= 5.0" | Y+R= 5.0" | Y+R= 5.0" | Y+R= 5.0" | Y+R= 5.0" |
      | OFF= 0.0% | OFF=11.7% | OFF=17.5% | OFF=56.7% | OFF=65.0% | OFF=76.7% |
      -----------------------------------------------------------------------
      C=120 sec   G= 90.0 sec = 75.0%  Y=30.0 sec = 25.0%  Ped= 0.0 sec =  0.0%
```

Lane Group	Width/ Lanes	g/C Reqd	g/C Used	Service Rate @C (vph)	Service Rate @E	Adj Volume	v/c	HCM Delay	L S	Queue Model 1
SB Approach								32.6	C	
RT	12/1	0.301	0.608	879	963	172	0.179	10.7	B+	127 ft
TH	12/1	0.333	0.408	580	761	372	0.489	26.7	C+	409 ft
LT	12/1	0.282	0.133	1	208	183	0.775	65.2	*E+	295 ft
NB Approach								60.2	E+	
RT	12/1	0.245	0.433	503	686	22	0.032	19.6	B	23 ft
TH	12/1	0.423	0.350	422	652	617	0.946	60.8	*E+	962 ft
LT	12/1	0.258	0.075	1	105	89	0.669	66.3	*E+	147 ft
WB Approach								60.1	E+	
RT	12/1	0.373	0.367	274	581	289	0.497	35.7	D+	368 ft
TH	24/2	0.343	0.192	1	670	644	0.950	71.1	*E	587 ft
LT	12/1	0.252	0.042	1	51	11	0.149	56.4	*E+	18 ft
EB Approach								43.0	D+	
RT	12/1	0.340	0.425	408	673	211	0.314	27.7	C	251 ft
TH	24/2	0.326	0.308	419	1091	539	0.494	36.5	D+	374 ft
LT	12/1	0.320	0.158	1	254	239	0.854	70.9	*E	397 ft

Institute for Astronomy
PM Peak Hour of Traffic
Base Year 2006 with Halekala Highway widening

01/07/04
15:47:05

SIGNAL2000/TEAPAC[Ver 1.11.00] - Summary of Parameter Values

Intersection Parameters for Int # 0 - Haleakala Highway/Makawao Aven

METROAREA		NONCBD		
SIMULATION PERIOD			15	
LEVELOFSERVICE		C	S	
NODELOCATION		0	0	
QUEUEMODELS	1	90	25	40

Approach Parameters

APPLABELS	SB	WB	NB	EB
GRADES	0.0	0.0	0.0	0.0
PEDLEVELS	0	0	0	0
BIKEVOLUMES	0	0	0	0
PARKINGSIDES	NONE	NONE	NONE	NONE
PARKVOLUMES	20	20	20	20
BUSVOLUMES	0	0	0	0
RIGHTTURNONREDS	0	0	0	0
UPSTREAMVC	0.00	0.00	0.00	0.00

Movement Parameters

MOVLABELS	RT	TH	LT	RT	TH	LT	RT	TH	LT	RT	TH	LT
VOLUMES	155	335	165	260	580	10	20	555	80	190	485	215
WIDTHS	12.0	12.0	12.0	12.0	24.0	12.0	12.0	12.0	12.0	12.0	24.0	12.0
LANES	1	1	1	1	2	1	1	1	1	1	2	1
GROUPTYPES	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM
UTILIZATIONS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRUCKPERCENTS	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
PEAKHOURFACTORS	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
ARRIVALTYPES	3	3	3	2	2	2	3	3	3	2	2	2
ACTUATIONS	NO	YES	YES	NO	YES	YES	NO	YES	YES	NO	YES	YES
REQCLEARANCES	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
MINIMUMS	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
STARTUPLOST	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
ENDGAIN	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
STORAGE	0	0	0	0	0	0	0	0	0	0	0	0
INITIALQUEUE	0	0	0	0	0	0	0	0	0	0	0	0
IDEALSATFLOWS	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
FACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
DELAYFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
NSTOPFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
SATURATIONFLOWS	1583	1863	1770	1583	3539	1770	1583	1863	1770	1583	3539	1770

Phasing Parameters

SEQUENCES	56	56							
PERMISSIVES	NO	NO	NO	NO			LEADLAGS	NONE	NONE
OVERLAPS	YES	YES	YES	YES			OFFSET	0.00	1
CYCLES	120	120	90				PEDTIME	0.0	0
GREENTIMES	9.00	2.00	42.00	5.00	9.00	23.00			
YELLOWTIMES	5.00	5.00	5.00	5.00	5.00	5.00			
CRITICALS	9	3	8	6	12	5			
EXCESS	0								

```
Institute for Astronomy                                                01/07/04
PM Peak Hour of Traffic                                                15:55:38
Base Year 2006

SIGNAL2000/TEAPAC[Ver 1.11.00] - Capacity Analysis Summary

Intersection Averages for Int #    0 - Kula Highway/Haleakala Highway
    Degree of Saturation (v/c) 0.80  Vehicle Delay  44.6  Level of Service D+

       ------------------------------------------------------
Sq 61 |  Phase 1  |  Phase 2  |  Phase 3  |  Phase 4  |
**/** ------------------------------------------------------
      |     *     |           | + *       |           |
      |     *     |           | + *       |           |
 /|\  |     *>    |           |<+ *       |    ^ <****|
  |   |           |           |   v       |       ****|
  |   |           |       ^   |        ^  |++++   v   |
North |    <+     |    <* +   |        +  |++++>      |
  |   |     +     |     * +   |        +  |           |
      |     +     |     * +   |        +  |           |
       ------------------------------------------------------
      | G/C=0.058 | G/C=0.200 | G/C=0.417 | G/C=0.158 |
      | G=   7.0" | G=  24.0" | G=  50.0" | G=  19.0" |
      | Y+R= 5.0" | Y+R= 5.0" | Y+R= 5.0" | Y+R= 5.0" |
      | OFF= 0.0% | OFF=10.0% | OFF=34.2% | OFF=80.0% |
       ------------------------------------------------------
      C=120 sec   G=100.0 sec = 83.3%  Y=20.0 sec = 16.7%  Ped= 0.0 sec =  0.0%

-------------------------------------------------------------------------------
| Lane   |Width/|     g/C     | Service Rate|  Adj  |       |  HCM  | L | Queue |
| Group  | Lanes| Reqd   Used | @C (vph) @E |Volume|  v/c  | Delay | S |Model 1|
-------------------------------------------------------------------------------
SB Approach                                                  55.3   E+
===============================================================================
|   RT   | 12/1 |0.251 |0.417 |  390 |  660 |    6 |0.009 |  23.6 | C+|    8 ft|
|   TH   | 12/1 |0.492 |0.417 |  523 |  776 |  711 |0.916 |  53.6 |*D |1054 ft|
|   LT   | 12/1 |0.270 |0.058 |    1 |   77 |   72 |0.699 |  74.4 |*E | 124 ft|
-------------------------------------------------------------------------------
NB Approach                                                  36.0   D+
===============================================================================
|   TH   | 12/1 |0.562 |0.658 | 1099 | 1226 |  878 |0.716 |  22.3 | C+| 999 ft|
|   LT   | 12/1 |0.410 |0.300 |  174 |  525 |  478 |0.900 |  61.1 |*E+| 744 ft|
-------------------------------------------------------------------------------
WB Approach                                                  63.0   E+
===============================================================================
|  TH+LT| 12/1 |0.291 |0.158 |    1 |  193 |  167 |0.763 |  63.0 |*E+| 268 ft|
-------------------------------------------------------------------------------
EB Approach                                                  45.7   D
===============================================================================
|  TH+LT| 12/1 |0.260 |0.158 |    1 |  264 |  100 |0.345 |  45.7 | D | 140 ft|
-------------------------------------------------------------------------------
```

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Institute for Astronomy                                                01/07/04
PM Peak Hour of Traffic                                                15:55:51
Base Year 2006

SIGNAL2000/TEAPAC[Ver 1.11.00] - Summary of Parameter Values

   Intersection Parameters for Int #    0 - Kula Highway/Haleakala Highway
METROAREA            NONCBD
SIMULATION PERIOD        15
LEVELOFSERVICE       C    S
NODELOCATION         0    0
QUEUEMODELS     1  90  25  40

   Approach Parameters
APPLABELS             SB                NB                NB                EB
GRADES               0.0               0.0               0.0               0.0
PEDLEVELS              0                 0                 0                 0
BIKEVOLUMES            0                 0                 0                 0
PARKINGSIDES        NONE              NONE              NONE              NONE
PARKVOLUMES           20                20                20                20
BUSVOLUMES             0                 0                 0                 0
RIGHTTURNONREDS        0                 0                 0                 0
UPSTREAMVC          0.00              0.00              0.00              0.00

   Movement Parameters
MOVLABELS           RT    TH    LT    RT    TH    LT    RT    TH    LT    RT    TH    LT
VOLUMES              5   640    65    80    80    70    55   790   430   410    85     5
WIDTHS            12.0  12.0  12.0  12.0  12.0   0.0  12.0  12.0  12.0  12.0  12.0   0.0
LANES                1     1     1     1     1     0     1     1     1     1     1     0
GROUPTYPES        NORM  NORM  NORM  FFLW  NORM  NORM  FFLW  NORM  NORM  FFLW  NORM  NORM
UTILIZATIONS      0.00  0.00  0.00  0.00  0.00  0.00  0.00  0.00  0.00  0.00  0.00  0.00
TRUCKPERCENTS      2.0   2.0   2.0   2.0   2.0   2.0   2.0   2.0   2.0   2.0   2.0   2.0
PEAKHOURFACTORS   0.90  0.90  0.90  0.90  0.90  0.90  0.90  0.90  0.90  0.90  0.90  0.90
ARRIVALTYPES         2     2     2     3     3     3     2     2     2     3     3     3
ACTUATIONS          NO   YES   YES    NO   YES   YES    NO   YES   YES    NO   YES   YES
REQCLEARANCES      5.0   5.0   5.0   5.0   5.0   5.0   5.0   5.0   5.0   5.0   5.0   5.0
MINIMUMS           5.0   5.0   5.0   5.0   5.0   5.0   5.0   5.0   5.0   5.0   5.0   5.0
STARTUPLOST        2.0   2.0   2.0   2.0   2.0   2.0   2.0   2.0   2.0   2.0   2.0   2.0
ENDGAIN            2.0   2.0   2.0   2.0   2.0   2.0   2.0   2.0   2.0   2.0   2.0   2.0
STORAGE              0     0     0     0     0     0     0     0     0     0     0     0
INITIALQUEUE         0     0     0     0     0     0     0     0     0     0     0     0
IDEALSATFLOWS     1900  1900  1900  1900  1900  1900  1900  1900  1900  1900  1900  1900
FACTORS           1.00  1.00  1.00  1.00  1.00  1.00  1.00  1.00  1.00  1.00  1.00  1.00
DELAYFACTORS      1.00  1.00  1.00  1.00  1.00  1.00  1.00  1.00  1.00  1.00  1.00  1.00
NSTOPFACTORS      1.00  1.00  1.00  1.00  1.00  1.00  1.00  1.00  1.00  1.00  1.00  1.00
SATURATIONFLOWS   1583  1863  1770     0  1380     0     0  1863  1770     0  1831     0

   Phasing Parameters
SEQUENCES           61    61
PERMISSIVES         NO    NO    NO    NO               LEADLAGS       NONE    NONE
OVERLAPS           YES   YES   YES   YES               OFFSET         0.00       1
CYCLES             120   180    60                     PEDTIME         0.0       0
GREENTIMES        7.00 24.00 50.00 19.00
YELLOWTIMES       5.00  5.00  5.00  5.00
CRITICALS            3     9     2     5
EXCESS               0
```

ATA AUSTIN, TSUTSUMI & ASSOCIATES, INC.
CIVIL ENGINEERS • SURVEYORS

APPENDIX C

LEVEL OF SERVICE CALCULATIONS

- Base Year 2006 with Phase 1 and Phase 2

Institute for Astronomy
AM Peak Hour of Traffic
Year 2006 with Phases 1 and 2

01/07/04
14:10:15

SIGNAL2000/TEAPAC[Ver 1.11.00] - Capacity Analysis Summary

Intersection Averages for Int # 0 - Haleakala Highway/Old Haleakal
Degree of Saturation (v/c) 0.89 Vehicle Delay 72.2 Level of Service E

```
        ---------------------------
Sq 11 | Phase 1  |  Phase 2  |
**/** ---------------------------
      |          |           |
 /|\  |          |     <****|
  |   |          |           |
  |   |          |           |
North |   <*     |++++>      |
  |   |    *     |           |
      |    *     |           |
      ---------------------------
      | G/C=0.500 | G/C=0.444 |
      | G= 90.0"  | G= 80.0"  |
      | Y+R= 5.0" | Y+R= 5.0" |
      | OFF= 0.0% | OFF=52.8% |
      ---------------------------
C=180 sec   G=170.0 sec = 94.4%   Y=10.0 sec = 5.6%   Ped= 0.0 sec = 0.0%
```

Lane Group	Width/ Lanes	g/C Reqd	g/C Used	Service Rate @C (vph)	Service Rate @E	Adj Volume	v/c	HCM Delay	L S	Queue Model 1
NB Approach								90.6	F	
LT	12/1	0.616	0.500	575	885	933	1.054	90.6	*F	2180 ft
WB Approach								72.3	E	
TH	24/2	0.610	0.444	227	1565	1517	0.964	72.3	*E	1721 ft
EB Approach								31.7	C	
TH	24/2	0.416	0.444	714	1573	428	0.272	31.7	C	316 ft

Institute for Astronomy
AM Peak Hour of Traffic
Year 2006 with Phases 1 and 2

01/07/04
14:12:21

SIGNAL2000/TEAPAC[Ver 1.11.00] - Summary of Parameter Values

Intersection Parameters for Int # 0 - Haleakala Highway/Old Haleakal

METROAREA	NONCBD			
SIMULATION PERIOD	15			
LEVELOFSERVICE	C	S		
NODELOCATION	0	0		
QUEUEMODELS	1	90	25	40

Approach Parameters

APPLABELS	SB	WB	NB	EB
GRADES	0.0	0.0	0.0	0.0
PEDLEVELS	0	0	0	0
BIKEVOLUMES	0	0	0	0
PARKINGSIDES	NONE	NONE	NONE	NONE
PARKVOLUMES	20	20	20	20
BUSVOLUMES	0	0	0	0
RIGHTTURNONREDS	0	0	0	0
UPSTREAMVC	0.00	0.00	0.00	0.00

Movement Parameters

MOVLABELS	RT	TH	LT	RT	TH	LT	RT	TH	LT	RT	TH	LT
VOLUMES	0	0	0	0	1365	0	5	0	840	290	385	0
WIDTHS	0.0	0.0	0.0	0.0	24.0	0.0	12.0	0.0	12.0	12.0	24.0	0.0
LANES	0	0	0	0	2	0	1	0	1	1	2	0
GROUPTYPES	NORM	NORM	NORM	NORM	NORM	NORM	FFLW	NORM	NORM	FFLW	NORM	NORM
UTILIZATIONS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRUCKPERCENTS	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
PEAKHOURFACTORS	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
ARRIVALTYPES	3	3	3	2	2	2	3	3	3	3	3	3
ACTUATIONS	NO	YES	YES	NO	YES	YES	NO	YES	YES	NO	YES	YES
REQCLEARANCES	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
MINIMUMS	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
STARTUPLOST	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
ENDGAIN	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
STORAGE	0	0	0	0	0	0	0	0	0	0	0	0
INITIALQUEUE	0	0	0	0	0	0	0	0	0	0	0	0
IDEALSATFLOWS	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
FACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
DELAYFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
NSTOPFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
SATURATIONFLOWS	0	0	0	0	3539	0	0	0	1770	0	3539	0

Phasing Parameters

SEQUENCES	11	11					
PERMISSIVES	YES	YES	YES	YES	LEADLAGS	NONE	NONE
OVERLAPS	YES	YES	YES	YES	OFFSET	0.00	1
CYCLES	85	170	85		PEDTIME	0.0	0
GREENTIMES	90.00	80.00					
YELLOWTIMES	5.00	5.00					
CRITICALS	9	5					
EXCESS	0						

```
Institute for Astronomy                                          01/07/04
PM Peak Hour of Traffic                                          16:08:03
Year 2006 with Phases 1 and 2

SIGNAL2000/TEAPAC[Ver 1.11.00] - Capacity Analysis Summary

Intersection Averages for Int #   0 - Haleakala Highway/Old Haleakal
    Degree of Saturation (v/c) 0.66  Vehicle Delay  15.1   Level of Service B

      -------------------------
Sq 11 |  Phase 1  |  Phase 2  |
**/** -------------------------
      |           |           |
 /|\  |           |      <++++|
  |   |           |           |
  |   |           |           |
North |    <*     |****>      |
  |   |     *     |           |
      |     *     |           |
      -------------------------
      | G/C=0.367 | G/C=0.467 |
      | G= 22.0"  | G= 28.0"  |
      | Y+R= 5.0" | Y+R= 5.0" |
      | OFF= 0.0% | OFF=45.0% |
      -------------------------
    C= 60 sec   G= 50.0 sec = 83.3%  Y=10.0 sec = 16.7%  Ped= 0.0 sec =  0.0%

------------------------------------------------------------------------------
| Lane   |Width/|    g/C     | Service Rate|  Adj  |       |  HCM  | L | Queue |
| Group  | Lanes| Reqd  Used | @C (vph) @E |Volume|  v/c  | Delay | S |Model 1|
------------------------------------------------------------------------------

NB Approach                                                18.1   B
==============================================================================
|  LT    | 12/1 |0.277 |0.367 |  591 |  649 |  422 |0.650 |  18.1 |*B | 282 ft|
------------------------------------------------------------------------------

WB Approach                                                14.6   B+
==============================================================================
|  TH    | 24/2 |0.293 |0.467 | 1608 | 1652 |  956 |0.579 |  14.6 | B+| 326 ft|
------------------------------------------------------------------------------

EB Approach                                                14.4   B+
==============================================================================
|  TH    | 24/2 |0.352 |0.467 | 1632 | 1652 | 1189 |0.720 |  14.4 |*B+| 400 ft|
------------------------------------------------------------------------------
```

```
Institute for Astronomy                                                    01/07/04
PM Peak Hour of Traffic                                                    16:08:18
Year 2006 with Phases 1 and 2

SIGNAL2000/TEAPAC[Ver 1.11.00] - Summary of Parameter Values

   Intersection Parameters for Int #   0 - Haleakala Highway/Old Haleakal
METROAREA              NONCBD
SIMULATION PERIOD          15
LEVELOFSERVICE          C   S
NODELOCATION            0   0
QUEUEMODELS      1  90  25  40

   Approach Parameters
APPLABELS            SB            WB            NB            EB
GRADES              0.0           0.0           0.0           0.0
PEDLEVELS             0             0             0             0
BIKEVOLUMES           0             0             0             0
PARKINGSIDES       NONE          NONE          NONE          NONE
PARKVOLUMES          20            20            20            20
BUSVOLUMES            0             0             0             0
RIGHTTURNONREDS       0             0             0             0
UPSTREAMVC         0.00          0.00          0.00          0.00

   Movement Parameters
MOVLABELS          RT   TH   LT     RT   TH   LT     RT   TH   LT     RT   TH   LT
VOLUMES             0    0    0      0  860    0      5    0  380    695 1070    0
WIDTHS            0.0  0.0  0.0    0.0 24.0  0.0   12.0  0.0 12.0   12.0 24.0  0.0
LANES               0    0    0      0    2    0      1    0    1      1    2    0
GROUPTYPES       NORM NORM NORM   NORM NORM NORM   FFLW NORM NORM   FFLW NORM NORM
UTILIZATIONS     0.00 0.00 0.00   0.00 0.00 0.00   0.00 0.00 0.00   0.00 0.00 0.00
TRUCKPERCENTS     2.0  2.0  2.0    2.0  2.0  2.0    2.0  2.0  2.0    2.0  2.0  2.0
PEAKHOURFACTORS  0.90 0.90 0.90   0.90 0.90 0.90   0.90 0.90 0.90   0.90 0.90 0.90
ARRIVALTYPES        3    3    3      2    2    2      3    3    3      3    3    3
ACTUATIONS         NO  YES  YES     NO  YES  YES     NO  YES  YES     NO  YES  YES
REQCLEARANCES     5.0  5.0  5.0    5.0  5.0  5.0    5.0  5.0  5.0    5.0  5.0  5.0
MINIMUMS          5.0  5.0  5.0    5.0  5.0  5.0    5.0  5.0  5.0    5.0  5.0  5.0
STARTUPLOST       2.0  2.0  2.0    2.0  2.0  2.0    2.0  2.0  2.0    2.0  2.0  2.0
ENDGAIN           2.0  2.0  2.0    2.0  2.0  2.0    2.0  2.0  2.0    2.0  2.0  2.0
STORAGE             0    0    0      0    0    0      0    0    0      0    0    0
INITIALQUEUE        0    0    0      0    0    0      0    0    0      0    0    0
IDEALSATFLOWS    1900 1900 1900   1900 1900 1900   1900 1900 1900   1900 1900 1900
FACTORS          1.00 1.00 1.00   1.00 1.00 1.00   1.00 1.00 1.00   1.00 1.00 1.00
DELAYFACTORS     1.00 1.00 1.00   1.00 1.00 1.00   1.00 1.00 1.00   1.00 1.00 1.00
NSTOPFACTORS     1.00 1.00 1.00   1.00 1.00 1.00   1.00 1.00 1.00   1.00 1.00 1.00
SATURATIONFLOWS     0    0    0      0 3539    0      0    0 1770      0 3539    0

   Phasing Parameters
SEQUENCES           11     11
PERMISSIVES        YES    YES    YES    YES         LEADLAGS       NONE    NONE
OVERLAPS           YES    YES    YES    YES         OFFSET         0.00       1
CYCLES              85    170     85                PEDTIME         0.0       0
GREENTIMES       22.00  28.00
YELLOWTIMES       5.00   5.00
CRITICALS            9     11
EXCESS               0
```

Institute for Astronomy
AM Peak Hour of Traffic
Year 2006 with Phases 1 and 2

01/07/04
14:08:02

SIGNAL2000/TEAPAC[Ver 1.11.00] - Capacity Analysis Summary

Intersection Averages for Int # 0 - Haleakala Highway/Old Haleakal
Degree of Saturation (v/c) 0.57 Vehicle Delay 9.0 Level of Service A

```
        ---------------------------
Sq  0 | Phase 1  |  Phase 2  |
**/** ---------------------------
      |          |           |
  .   |          |           |
 /|\  |     <++++|      <****|
  |   |          |           |
  |   |          |           |
North |    <*    |++++>      |
  |   |     *    |           |
      |     *    |           |
      ---------------------------
      | G/C=0.711 | G/C=0.178 |
      | G= 64.0"  | G= 16.0"  |
      | Y+R= 5.0" | Y+R= 5.0" |
      | OFF= 0.0% | OFF=76.7% |
      ---------------------------
      C= 90 sec   G= 80.0 sec = 88.9%  Y=10.0 sec = 11.1%  Ped= 0.0 sec = 0.0%
```

Lane Group	Width/ Lanes	g/C Reqd	g/C Used	Service Rate @C (vph)	Service Rate @E	Adj Volume	v/c	HCM Delay	L S	Queue Model 1
NB Approach								10.3	B+	
LT	12/1	0.560	0.711	1243	1258	933	0.742	10.3	*B+	655 ft
WB Approach								0.1	A	
TH	24/2	0.469	1.000	3539	3539	1517	0.429	0.1	*A	34 ft
EB Approach								37.6	D+	
TH	24/2	0.194	0.178	356	629	428	0.680	37.6	D+	257 ft

Institute for Astronomy
AM Peak Hour of Traffic
Year 2006 with Phases 1 and 2

01/07/04
14:08:14

SIGNAL2000/TEAPAC[Ver 1.11.00] - Summary of Parameter Values

Intersection Parameters for Int # 0 - Haleakala Highway/Old Haleakal

METROAREA	NONCBD			
SIMULATION PERIOD	15			
LEVELOFSERVICE	C	S		
NODELOCATION	0	0		
QUEUEMODELS	1	90	25	40

Approach Parameters

APPLABELS	SB	WB	NB	EB
GRADES	0.0	0.0	0.0	0.0
PEDLEVELS	0	0	0	0
BIKEVOLUMES	0	0	0	0
PARKINGSIDES	NONE	NONE	NONE	NONE
PARKVOLUMES	20	20	20	20
BUSVOLUMES	0	0	0	0
RIGHTTURNONREDS	0	0	0	0
UPSTREAMVC	0.00	0.00	0.00	0.00

Movement Parameters

MOVLABELS	RT	TH	LT	RT	TH	LT	RT	TH	LT	RT	TH	LT
VOLUMES	0	0	0	0	1365	0	5	0	840	290	385	0
WIDTHS	0.0	0.0	0.0	0.0	24.0	0.0	12.0	0.0	12.0	12.0	24.0	0.0
LANES	0	0	0	0	2	0	1	0	1	1	2	0
GROUPTYPES	NORM	NORM	NORM	NORM	NORM	NORM	FFLW	NORM	NORM	FFLW	NORM	NORM
UTILIZATIONS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRUCKPERCENTS	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
PEAKHOURFACTORS	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
ARRIVALTYPES	3	3	3	2	2	2	3	3	3	3	3	3
ACTUATIONS	NO	YES	YES	NO	YES	YES	NO	YES	YES	NO	YES	YES
REQCLEARANCES	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
MINIMUMS	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
STARTUPLOST	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
ENDGAIN	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
STORAGE	0	0	0	0	0	0	0	0	0	0	0	0
INITIALQUEUE	0	0	0	0	0	0	0	0	0	0	0	0
IDEALSATFLOWS	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
FACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
DELAYFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
NSTOPFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
SATURATIONFLOWS	0	0	0	0	3539	0	0	0	1770	0	3539	0

```
Institute for Astronomy                                          01/07/04
AM Peak Hour of Traffic                                          14:08:14
Year 2006 with Phases 1 and 2

SIGNAL2000/TEAPAC[Ver 1.11.00] - Summary of Parameter Values

  Phasing Parameters
SEQUENCES            0     0
PERMISSIVES        YES   YES   YES   YES        LEADLAGS    NONE   NONE
OVERLAPS           YES   YES   YES   YES        OFFSET      0.00      1
CYCLES              60   180    10              PEDTIME      0.0      0
GREENTIMES       64.00 16.00
YELLOWTIMES       5.00  5.00
CRITICALS            9     5
EXCESS               0
PHASEMOVEMENTS       1     9     5     0     0     0     0
PHASEMOVEMENTS       2     5    11     0     0     0     0
PHASEMOVEMENTS       3     0     0     0     0     0     0
PHASEMOVEMENTS       4     0     0     0     0     0     0
PHASEMOVEMENTS       5     0     0     0     0     0     0
PHASEMOVEMENTS       6     0     0     0     0     0     0
```

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Institute for Astronomy                                              01/07/04
PM Peak Hour of Traffic                                              16:09:03
Year 2006 with Phases 1 and 2

SIGNAL2000/TEAPAC[Ver 1.11.00] - Capacity Analysis Summary

Intersection Averages for Int #   0 - Haleakala Highway/Old Haleakal
      Degree of Saturation (v/c) 0.53  Vehicle Delay    9.3   Level of Service A

      ---------------------------
Sq  0 |  Phase 1   |  Phase 2   |
**/** ---------------------------
      |            |            |
 /|\  |      <++++|      <++++|
  |   |            |            |
  |   |            |            |
North |    <+      |++++>       |
  |   |     *      |            |
      |     *      |            |
      ---------------------------
      | G/C=0.333  | G/C=0.500  |
      | G=  20.0"  | G=  30.0"  |
      | Y+R= 5.0"  | Y+R= 5.0"  |
      | OFF= 0.0%  | OFF=41.7%  |
      ---------------------------
      C= 60 sec   G= 50.0 sec = 83.3%  Y=10.0 sec = 16.7%  Ped= 0.0 sec =  0.0%

-------------------------------------------------------------------------------
| Lane   |Width/|     g/C      | Service Rate|  Adj  |       |  HCM  | L | Queue |
|  Group | Lanes| Reqd   Used  | @C (vph) @E |Volume|  v/c  | Delay | S |Model 1|
-------------------------------------------------------------------------------
NB Approach                                                    21.6    C+
===============================================================================
|   LT   | 12/1 |0.277 |0.333 |  528 |  590 |  422 |0.715 |  21.6 |*C+| 302 ft|
-------------------------------------------------------------------------------
WB Approach                                                     0.0    A
===============================================================================
|   TH   | 24/2 |0.293 |1.000 | 3539 | 3539 |  956 |0.270 |   0.0 |*A |  13 ft|
-------------------------------------------------------------------------------
EB Approach                                                    12.3    B+
===============================================================================
|   TH   | 24/2 |0.352 |0.500 | 1761 | 1770 | 1189 |0.672 |  12.3 | B+| 372 ft|
-------------------------------------------------------------------------------
```

Institute for Astronomy
PM Peak Hour of Traffic
Year 2006 with Phases 1 and 2

01/07/04
16:09:10

SIGNAL2000/TEAPAC[Ver 1.11.00] - Summary of Parameter Values

Intersection Parameters for Int # 0 - Haleakala Highway/Old Haleakal

METROAREA		NONCBD		
SIMULATION PERIOD		15		
LEVELOFSERVICE		C	S	
NODELOCATION		0	0	
QUEUEMODELS	1	90	25	40

Approach Parameters

APPLABELS	SB	WB	NB	EB
GRADES	0.0	0.0	0.0	0.0
PEDLEVELS	0	0	0	0
BIKEVOLUMES	0	0	0	0
PARKINGSIDES	NONE	NONE	NONE	NONE
PARKVOLUMES	20	20	20	20
BUSVOLUMES	0	0	0	0
RIGHTTURNONREDS	0	0	0	0
UPSTREAMVC	0.00	0.00	0.00	0.00

Movement Parameters

MOVLABELS	RT	TH	LT	RT	TH	LT	RT	TH	LT	RT	TH	LT
VOLUMES	0	0	0	0	860	0	5	0	380	695	1070	0
WIDTHS	0.0	0.0	0.0	0.0	24.0	0.0	12.0	0.0	12.0	12.0	24.0	0.0
LANES	0	0	0	0	2	0	1	0	1	1	2	0
GROUPTYPES	NORM	NORM	NORM	NORM	NORM	NORM	FFLW	NORM	NORM	FFLW	NORM	NORM
UTILIZATIONS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRUCKPERCENTS	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
PEAKHOURFACTORS	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
ARRIVALTYPES	3	3	3	2	2	2	3	3	3	3	3	3
ACTUATIONS	NO	YES	YES	NO	YES	YES	NO	YES	YES	NO	YES	YES
REQCLEARANCES	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
MINIMUMS	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
STARTUPLOST	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
ENDGAIN	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
STORAGE	0	0	0	0	0	0	0	0	0	0	0	0
INITIALQUEUE	0	0	0	0	0	0	0	0	0	0	0	0
IDEALSATFLOWS	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
FACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
DELAYFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
NSTOPFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
SATURATIONFLOWS	0	0	0	0	3539	0	0	0	1770	0	3539	0

Institute for Astronomy
PM Peak Hour of Traffic
Year 2006 with Phases 1 and 2

01/07/04
16:09:10

SIGNAL2000/TEAPAC[Ver 1.11.00] - Summary of Parameter Values

Phasing Parameters

SEQUENCES	0	0					
PERMISSIVES	YES	YES	YES	YES			
OVERLAPS	YES	YES	YES	YES			
CYCLES	60	180	10				
GREENTIMES	20.00	30.00					
YELLOWTIMES	5.00	5.00					
CRITICALS	9	5					
EXCESS	0						
PHASEMOVEMENTS	1	9	5	0	0	0	0
PHASEMOVEMENTS	2	5	11	0	0	0	0
PHASEMOVEMENTS	3	0	0	0	0	0	0
PHASEMOVEMENTS	4	0	0	0	0	0	0
PHASEMOVEMENTS	5	0	0	0	0	0	0
PHASEMOVEMENTS	6	0	0	0	0	0	0

LEADLAGS	NONE	NONE
OFFSET	0.00	1
PEDTIME	0.0	0

HCS2000: Ramps and Ramp Junctions Release 4.1d

Tara Lucas
ATA
501 Sumner Street
Suite 521
Honolulu, Hawaii 96817
Phone: (808)533-3646 Fax:
E-mail: atahnl@atahawaii.com

Merge Analysis

Analyst:	TL
Agency/Co.:	ATA
Date performed:	1/8/2004
Analysis time period:	AM peak
Freeway/Dir of Travel:	Haleakala Highway/westbound
Junction:	west of HH/OHH western int
Jurisdiction:	Maui
Analysis Year:	Year 2006 with Phases 1 and 2
Description:	Institute for Astronomy

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	55.0	mph
Volume on freeway	1365	vph

On Ramp Data

Side of freeway	Left	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	840	vph
Length of first accel/decel lane	500	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	1365	840		vph
Peak-hour factor, PHF	0.90	0.90		
Peak 15-min volume, v15	379	233		v
Trucks and buses	0	0		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		
Heavy vehicle adjustment, fHV	1.000	1.000		
Driver population factor, fP	1.00	1.00		
Flow rate, vp	1517	933		pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = 1.000 Using Equation 0

$v_{12} = v_F (P_{FM})$ = 1517 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	2450	4500	No
v_{R12}	2632	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\, v_R + 0.0078\, v_{12} - 0.00627\, L_A$ = 21.0 pc/mi/ln

Level of service for ramp-freeway junction areas of influence C

Speed Estimation

Intermediate speed variable,	M_S = 0.340	
Space mean speed in ramp influence area,	S_R = 50.6	mph
Space mean speed in outer lanes,	S_0 = N/A	mph
Space mean speed for all vehicles,	S = 50.6	mph

HCS2000: Ramps and Ramp Junctions Release 4.1d

Tara Lucas
ATA
501 Sumner Street
Suite 521
Honolulu, Hawaii 96817
Phone: (808)533-3646 Fax:
E-mail: atahnl@atahawaii.com

Merge Analysis

Analyst:	TL
Agency/Co.:	ATA
Date performed:	1/8/2004
Analysis time period:	PM peak
Freeway/Dir of Travel:	Haleakala Highway/westbound
Junction:	west of HH/OHH western int
Jurisdiction:	Maui
Analysis Year:	Year 2006 with Phases 1 and 2
Description:	Institute for Astronomy

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	55.0	mph
Volume on freeway	860	vph

On Ramp Data

Side of freeway	Left	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	380	vph
Length of first accel/decel lane	500	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	860	380		vph
Peak-hour factor, PHF	0.90	0.90		
Peak 15-min volume, v15	239	106		v
Trucks and buses	0	0		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		
Heavy vehicle adjustment, fHV	1.000	1.000		
Driver population factor, fP	1.00	1.00		
Flow rate, vp	956	422		pcph

Estimation of V12 Merge Areas

$L =$ (Equation 25-2 or 25-3)

$P_{FM}^{EQ} =$ 1.000 Using Equation 0

$v_{12} = v_F (P_{FM}) =$ 956 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	1378	4500	No
v_{R12}	1492	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\ v_R + 0.0078\ v_{12} - 0.00627\ L_A =$ 12.9 pc/mi/ln

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable,	$M_S = 0.303$	
Space mean speed in ramp influence area,	$S_R = 51.1$	mph
Space mean speed in outer lanes,	$S_0 =$ N/A	mph
Space mean speed for all vehicles,	$S = 51.1$	mph

Institute for Astronomy
AM Peak Hour of Traffic
Year 2006 with Phases 1 and 2

01/09/04
17:31:05

SIGNAL2000/TEAPAC[Ver 1.11.00] - Capacity Analysis Summary

Intersection Averages for Int # 0 - Haleakala Highway/Makani Road
Degree of Saturation (v/c) 0.53 Vehicle Delay 21.3 Level of Service C+

```
       ---------------------------
Sq 11 |  Phase 1  |  Phase 2  |
**/** ---------------------------
      | * + +     |        ^  |
      | * + +     |     ****  |
 /|\  |<* + +>    |    <****  |
  |   |  v        |   ^  ++++ |
  |   |        ^  |++++   v   |
North |   <+ + +> |++++>      |
  |   |    + + +  |++++       |
      |    + + +  |   v       |
       ---------------------------
      | G/C=0.422 | G/C=0.467 |
      | G= 38.0"  | G= 42.0"  |
      | Y+R= 5.0" | Y+R= 5.0" |
      | OFF= 0.0% | OFF=47.8% |
       ---------------------------
      C= 90 sec   G= 80.0 sec = 88.9%  Y=10.0 sec = 11.1%  Ped= 0.0 sec = 0.0%
```

Lane Group	Width/ Lanes	g/C Reqd	g/C Used	Service Rate @C (vph)	Service Rate @E	Adj Volume	v/c	HCM Delay	L S	Queue Model 1
SB Approach								21.9	C+	
RT	12/1	0.341	0.422	559	669	400	0.598	24.0	*C+	359 ft
TH+LT	12/1	0.254	0.422	516	603	244	0.405	18.6	B	200 ft
NB Approach								16.4	B	
RT	12/1	0.189	0.422	559	669	106	0.158	16.6	B	84 ft
TH+LT	12/1	0.160	0.422	652	746	117	0.157	16.2	B	86 ft
WB Approach								24.3	C+	
RT+TH	24/2	0.382	0.467	1498	1640	1162	0.709	24.4	*C+	602 ft
LT	12/1	0.137	0.467	346	431	22	0.051	15.8	B	18 ft
EB Approach								14.9	B+	
RT+TH	24/2	0.189	0.467	1563	1648	406	0.246	14.5	B+	151 ft
LT	12/1	0.225	0.467	68	90	39	0.390	18.2	B	34 ft

Institute for Astronomy
AM Peak Hour of Traffic
Year 2006 with Phases 1 and 2

01/09/04
17:31:38

SIGNAL2000/TEAPAC[Ver 1.11.00] - Summary of Parameter Values

Intersection Parameters for Int # 0 - Haleakala Highway/Makani Road

METROAREA	NONCBD			
SIMULATION PERIOD	15			
LEVELOFSERVICE	C	S		
NODELOCATION	0	0		
QUEUEMODELS	1	90	25	40

Approach Parameters

APPLABELS	SB	WB	NB	EB
GRADES	0.0	0.0	0.0	0.0
PEDLEVELS	0	0	0	0
BIKEVOLUMES	0	0	0	0
PARKINGSIDES	NONE	NONE	NONE	NONE
PARKVOLUMES	20	20	20	20
BUSVOLUMES	0	0	0	0
RIGHTTURNONREDS	0	0	0	0
UPSTREAMVC	0.00	0.00	0.00	0.00

Movement Parameters

MOVLABELS	RT	TH	LT	RT	TH	LT	RT	TH	LT	RT	TH	LT
VOLUMES	360	100	120	50	995	20	95	90	15	5	360	35
WIDTHS	12.0	12.0	0.0	0.0	24.0	12.0	12.0	12.0	0.0	0.0	24.0	12.0
LANES	1	1	0	0	2	1	1	1	0	0	2	1
GROUPTYPES	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM
UTILIZATIONS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRUCKPERCENTS	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
PEAKHOURFACTORS	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
ARRIVALTYPES	3	3	3	2	2	2	3	3	3	3	3	3
ACTUATIONS	NO	YES	YES	NO	YES	YES	NO	YES	YES	NO	YES	YES
REQCLEARANCES	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
MINIMUMS	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
STARTUPLOST	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
ENDGAIN	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
STORAGE	0	0	0	0	0	0	0	0	0	0	0	0
INITIALQUEUE	0	0	0	0	0	0	0	0	0	0	0	0
IDEALSATFLOWS	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
FACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
DELAYFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
NSTOPFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
SATURATIONFLOWS	1583	1429	0	0	3514	923	1583	1766	0	0	3531	214

Phasing Parameters

SEQUENCES	11	11					
PERMISSIVES	NO	NO	NO	NO	LEADLAGS	NONE	NONE
OVERLAPS	YES	YES	YES	YES	OFFSET	0.00	1
CYCLES	90	180	90		PEDTIME	0.0	0
GREENTIMES	38.00	42.00					
YELLOWTIMES	5.00	5.00					
CRITICALS	1	5					
EXCESS	0						

Institute for Astronomy
PM Peak Hour of Traffic
Year 2006 with Phases 1 and 2

01/07/04
16:10:03

SIGNAL2000/TEAPAC[Ver 1.11.00] - Capacity Analysis Summary

Intersection Averages for Int # 0 - Haleakala Highway/Makani Road
Degree of Saturation (v/c) 0.40 Vehicle Delay 8.2 Level of Service A

```
       --------------------------
Sq 11 |  Phase 1   |  Phase 2   |
**/** --------------------------
      | * + +      |         ^  |
  .   | * + +      |        ++++|
 /|\  |<* + +>     |       <++++|
  |   |   v        |     ^  ++++|
  |   |       ^    |****    v   |
North |    <+ + +> |++++>       |
  |   |     + + +  |++++        |
      |     + + +  |    v       |
      --------------------------
      | G/C=0.167  | G/C=0.667  |
      | G=  10.0"  | G=  40.0"  |
      | Y+R= 5.0"  | Y+R= 5.0"  |
      | OFF= 0.0%  | OFF=25.0%  |
      --------------------------
      C= 60 sec   G= 50.0 sec = 83.3%  Y=10.0 sec = 16.7%  Ped= 0.0 sec =  0.0%
```

Lane Group	Width/ Lanes	g/C Reqd	g/C Used	Service Rate @C (vph)	Service Rate @E	Adj Volume	v/c	HCM Delay	L S	Queue Model 1
SB Approach								24.2	C+	
RT	12/1	0.115	0.167	171	264	94	0.356	25.9	*C+	74 ft
TH+LT	12/1	0.076	0.167	226	296	83	0.280	22.4	C+	59 ft
NB Approach								22.4	C+	
RT	12/1	0.059	0.167	171	264	28	0.106	22.0	C+	22 ft
TH+LT	12/1	0.082	0.167	233	304	95	0.313	22.6	C+	68 ft
WB Approach								7.1	A	
RT+TH	24/2	0.285	0.667	2347	2347	922	0.393	7.1	A	251 ft
LT	12/1	0.000	0.667	292	332	33	0.099	5.7	A	16 ft
EB Approach								5.2	A	
RT+TH	24/2	0.300	0.667	2356	2356	989	0.420	4.8	A	194 ft
LT	12/1	0.455	0.667	295	327	183	0.560	7.5	*A	88 ft

Institute for Astronomy
PM Peak Hour of Traffic
Year 2006 with Phases 1 and 2

01/07/04
16:10:14

SIGNAL2000/TEAPAC[Ver 1.11.00] - Summary of Parameter Values

Intersection Parameters for Int # 0 - Haleakala Highway/Makani Road

METROAREA	NONCBD			
SIMULATION PERIOD	15			
LEVELOFSERVICE	C	S		
NODELOCATION	0	0		
QUEUEMODELS	1	90	25	40

Approach Parameters

APPLABELS	SB	WB	NB	EB
GRADES	0.0	0.0	0.0	0.0
PEDLEVELS	0	0	0	0
BIKEVOLUMES	0	0	0	0
PARKINGSIDES	NONE	NONE	NONE	NONE
PARKVOLUMES	20	20	20	20
BUSVOLUMES	0	0	0	0
RIGHTTURNONREDS	0	0	0	0
UPSTREAMVC	0.00	0.00	0.00	0.00

Movement Parameters

MOVLABELS	RT	TH	LT	RT	TH	LT	RT	TH	LT	RT	TH	LT
VOLUMES	85	65	10	30	800	30	25	80	5	10	880	165
WIDTHS	12.0	12.0	0.0	0.0	24.0	12.0	12.0	12.0	0.0	0.0	24.0	12.0
LANES	1	1	0	0	2	1	1	1	0	0	2	1
GROUPTYPES	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM
UTILIZATIONS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRUCKPERCENTS	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
PEAKHOURFACTORS	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
ARRIVALTYPES	3	3	3	2	2	2	3	3	3	3	3	3
ACTUATIONS	NO	YES	YES	NO	YES	YES	NO	YES	YES	NO	YES	YES
REQCLEARANCES	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
MINIMUMS	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
STARTUPLOST	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
ENDGAIN	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
STORAGE	0	0	0	0	0	0	0	0	0	0	0	0
INITIALQUEUE	0	0	0	0	0	0	0	0	0	0	0	0
IDEALSATFLOWS	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
FACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
DELAYFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
NSTOPFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
SATURATIONFLOWS	1583	1775	0	0	3520	497	1583	1825	0	0	3533	491

Phasing Parameters

SEQUENCES	11	11					
PERMISSIVES	NO	NO	NO	NO	LEADLAGS	NONE	NONE
OVERLAPS	YES	YES	YES	YES	OFFSET	0.00	1
CYCLES	85	170	85		PEDTIME	0.0	0
GREENTIMES	10.00	40.00					
YELLOWTIMES	5.00	5.00					
CRITICALS	1	12					
EXCESS	0						

Institute for Astronomy
AM Peak Hour of Traffic
Year 2006 with Phases 1 and 2

01/07/04
16:14:13

SIGNAL2000/TEAPAC[Ver 1.11.00] - Capacity Analysis Summary

Intersection Averages for Int # 0 - Haleakala Highway/Makawao Aven
Degree of Saturation (v/c) 0.63 Vehicle Delay 33.8 Level of Service C

```
Sq 56 | Phase 1  | Phase 2   | Phase 3   | Phase 4   | Phase 5   | Phase 6  |
**/** ---------------------------------------------------------------------
      |     + ^  | + + * ^   | + +       | +         | +         |       ^  |
      |     + ++++| + + * ++++| + +      | +         | +         |    ++++|
 /|\  |     +>   |<+ + *>    |<+ +       |<+         |<+         |   <****|
  |   |          |   v       |   v       |   ^   ****|   ^       |        |
  |   |          |           |       ^   |++++   v   |****       |        |
North |    <*    |           |     * +>  |        +> |++++>      |++++>   |
  |   |++++ *    |           |     * +   |        +  |++++       |++++    |
      |   v *    |           |     * +   |        +  |   v       |   v    |
      ---------------------------------------------------------------------
      | G/C=0.067 | G/C=0.111 | G/C=0.111 | G/C=0.067 | G/C=0.044 | G/C=0.267 |
      | G=   6.0" | G=  10.0" | G=  10.0" | G=   6.0" | G=   4.0" | G=  24.0" |
      | Y+R= 5.0" | Y+R= 5.0" | Y+R= 5.0" | Y+R= 5.0" | Y+R= 5.0" | Y+R= 5.0" |
      | OFF= 0.0% | OFF=12.2% | OFF=28.9% | OFF=45.6% | OFF=57.8% | OFF=67.8% |
      ---------------------------------------------------------------------
      C= 90 sec   G= 60.0 sec = 66.7%  Y=30.0 sec = 33.3%  Ped= 0.0 sec =  0.0%
```

Lane Group	Width/ Lanes	g/C Reqd	g/C Used	Service Rate @C (vph)	Service Rate @E	Adj Volume	v/c	HCM Delay	L S	Queue Model 1
SB Approach								31.8	C	
RT	12/1	0.296	0.500	709	792	311	0.393	15.5	B	230 ft
TH	12/1	0.268	0.278	381	517	361	0.698	33.3	C	381 ft
LT	12/1	0.268	0.233	272	413	339	0.821	45.2	*D	401 ft
NB Approach								45.7	D	
RT	12/1	0.128	0.233	189	368	11	0.030	26.8	C+	11 ft
TH	12/1	0.166	0.111	1	190	144	0.696	48.3	*D	176 ft
LT	12/1	0.132	0.067	1	99	39	0.331	41.7	*D+	46 ft
WB Approach								35.2	D+	
RT	12/1	0.301	0.556	774	880	300	0.341	15.5	B	248 ft
TH	24/2	0.296	0.267	710	944	828	0.877	42.3	*D+	531 ft
LT	12/1	0.120	0.067	1	99	6	0.051	39.5	*D+	7 ft
EB Approach								30.7	C	
RT	12/1	0.169	0.489	650	774	72	0.093	15.3	B	64 ft
TH	24/2	0.173	0.367	1111	1298	333	0.257	22.2	C+	163 ft
LT	12/1	0.214	0.167	137	285	228	0.773	47.9	*D	280 ft

Institute for Astronomy
AM Peak Hour of Traffic
Year 2006 with Phases 1 and 2

01/07/04
16:14:29

SIGNAL2000/TEAPAC[Ver 1.11.00] - Summary of Parameter Values

Intersection Parameters for Int # 0 - Haleakala Highway/Makawao Aven

METROAREA	NONCBD			
SIMULATION PERIOD	15			
LEVELOFSERVICE	C	S		
NODELOCATION	0	0		
QUEUEMODELS	1	90	25	40

Approach Parameters

APPLABELS	SB	WB	NB	EB
GRADES	0.0	0.0	0.0	0.0
PEDLEVELS	0	0	0	0
BIKEVOLUMES	0	0	0	0
PARKINGSIDES	NONE	NONE	NONE	NONE
PARKVOLUMES	20	20	20	20
BUSVOLUMES	0	0	0	0
RIGHTTURNONREDS	0	0	0	0
UPSTREAMVC	0.00	0.00	0.00	0.00

Movement Parameters

MOVLABELS	RT	TH	LT	RT	TH	LT	RT	TH	LT	RT	TH	LT
VOLUMES	280	325	305	270	745	5	10	130	35	65	300	205
WIDTHS	12.0	12.0	12.0	12.0	24.0	12.0	12.0	12.0	12.0	12.0	24.0	12.0
LANES	1	1	1	1	2	1	1	1	1	1	2	1
GROUPTYPES	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM
UTILIZATIONS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRUCKPERCENTS	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
PEAKHOURFACTORS	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
ARRIVALTYPES	3	3	3	2	2	2	3	3	3	2	2	2
ACTUATIONS	NO	YES	YES	NO	YES	YES	NO	YES	YES	NO	YES	YES
REQCLEARANCES	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
MINIMUMS	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
STARTUPLOST	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
ENDGAIN	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
STORAGE	0	0	0	0	0	0	0	0	0	0	0	0
INITIALQUEUE	0	0	0	0	0	0	0	0	0	0	0	0
IDEALSATFLOWS	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
FACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
DELAYFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
NSTOPFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
SATURATIONFLOWS	1583	1863	1770	1583	3539	1770	1583	1863	1770	1583	3539	1770

Phasing Parameters

SEQUENCES	56	56							
PERMISSIVES	NO	NO	NO	NO			LEADLAGS	NONE	NONE
OVERLAPS	YES	YES	YES	YES			OFFSET	0.00	1
CYCLES	90	180	90				PEDTIME	0.0	0
GREENTIMES	6.00	10.00	10.00	6.00	4.00	24.00			
YELLOWTIMES	5.00	5.00	5.00	5.00	5.00	5.00			
CRITICALS	9	3	8	6	12	5			
EXCESS	0								

Institute for Astronomy
PM Peak Hour of Traffic
Year 2006 with Phases 1 and 2

01/07/04
16:13:08

SIGNAL2000/TEAPAC[Ver 1.11.00] - Capacity Analysis Summary

Intersection Averages for Int # 0 - Haleakala Highway/Makawao Aven
Degree of Saturation (v/c) 0.68 Vehicle Delay 50.4 Level of Service D

```
Sq 56 | Phase 1  | Phase 2   | Phase 3  | Phase 4  | Phase 5  | Phase 6  |
**/** ---------------------------------------------------------------------
      |     + ^  | + + * ^   | + +      | +        | +        |        ^ |
  .   |     + ++++| + + * ++++| + +      | +        | +        |     ++++|
 /|\  |     +>   |<+ + *>    |<+ +      |<+       |<+        |    <****|
  |   |          |   v       |   v      |    ^ ****|   ^      |          |
  |   |          |           |       ^  |++++  v  |****      |          |
North |   <*     |           |     * +>|       +>|++++>     |++++>     |
  |   |++++ *    |           |     * + |       + |++++      |++++      |
      |   v *    |           |     * + |       + |   v      |   v      |
      ---------------------------------------------------------------------
      | G/C=0.075 | G/C=0.017 | G/C=0.342 | G/C=0.042 | G/C=0.075 | G/C=0.200 |
      | G=   9.0" | G=   2.0" | G=  41.0" | G=   5.0" | G=   9.0" | G=  24.0" |
      | Y+R= 5.0" | Y+R= 5.0" | Y+R= 5.0" | Y+R= 5.0" | Y+R= 5.0" | Y+R= 5.0" |
      | OFF= 0.0% | OFF=11.7% | OFF=17.5% | OFF=55.8% | OFF=64.2% | OFF=75.8% |
      ---------------------------------------------------------------------
      C=120 sec   G= 90.0 sec = 75.0%  Y=30.0 sec = 25.0%  Ped= 0.0 sec =  0.0%
```

Lane Group	Width/Lanes	g/C Reqd	g/C Used	Service Rate @C (vph)	Service Rate @E	Adj Volume	v/c	HCM Delay	L S	Queue Model 1
SB Approach								34.2	C	
RT	12/1	0.301	0.600	863	950	172	0.181	11.2	B+	129 ft
TH	12/1	0.333	0.400	557	745	372	0.499	27.5	C	415 ft
LT	12/1	0.283	0.133	1	208	189	0.801	68.1	*E	309 ft
NB Approach								65.6	E+	
RT	12/1	0.245	0.425	483	673	22	0.033	20.2	C+	23 ft
TH	12/1	0.423	0.342	398	636	617	0.970	67.1	*E+	996 ft
LT	12/1	0.258	0.075	1	105	89	0.669	66.3	*E+	147 ft
WB Approach								59.2	E+	
RT	12/1	0.378	0.375	293	594	300	0.505	35.3	D+	380 ft
TH	24/2	0.348	0.200	1	703	672	0.949	69.9	*E	608 ft
LT	12/1	0.252	0.042	1	51	11	0.149	56.4	*E+	18 ft
EB Approach								42.4	D+	
RT	12/1	0.340	0.433	427	686	211	0.308	27.1	C+	249 ft
TH	24/2	0.328	0.317	475	1121	550	0.491	36.0	D+	379 ft
LT	12/1	0.320	0.158	1	254	239	0.854	70.9	*E	397 ft

Institute for Astronomy
PM Peak Hour of Traffic
Year 2006 with Phases 1 and 2

01/07/04
16:13:23

SIGNAL2000/TEAPAC[Ver 1.11.00] - Summary of Parameter Values

Intersection Parameters for Int # 0 - Haleakala Highway/Makawao Aven

```
METROAREA          NONCBD
SIMULATION PERIOD      15
LEVELOFSERVICE      C   S
NODELOCATION        0   0
QUEUEMODELS    1  90  25  40
```

Approach Parameters

APPLABELS	SB	WB	NB	EB
GRADES	0.0	0.0	0.0	0.0
PEDLEVELS	0	0	0	0
BIKEVOLUMES	0	0	0	0
PARKINGSIDES	NONE	NONE	NONE	NONE
PARKVOLUMES	20	20	20	20
BUSVOLUMES	0	0	0	0
RIGHTTURNONREDS	0	0	0	0
UPSTREAMVC	0.00	0.00	0.00	0.00

Movement Parameters

MOVLABELS	RT	TH	LT	RT	TH	LT	RT	TH	LT	RT	TH	LT
VOLUMES	155	335	170	270	605	10	20	555	80	190	495	215
WIDTHS	12.0	12.0	12.0	12.0	24.0	12.0	12.0	12.0	12.0	12.0	24.0	12.0
LANES	1	1	1	1	2	1	1	1	1	1	2	1
GROUPTYPES	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM
UTILIZATIONS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRUCKPERCENTS	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
PEAKHOURFACTORS	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
ARRIVALTYPES	3	3	3	2	2	2	3	3	3	2	2	2
ACTUATIONS	NO	YES	YES	NO	YES	YES	NO	YES	YES	NO	YES	YES
REQCLEARANCES	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
MINIMUMS	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
STARTUPLOST	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
ENDGAIN	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
STORAGE	0	0	0	0	0	0	0	0	0	0	0	0
INITIALQUEUE	0	0	0	0	0	0	0	0	0	0	0	0
IDEALSATFLOWS	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
FACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
DELAYFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
NSTOPFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
SATURATIONFLOWS	1583	1863	1770	1583	3539	1770	1583	1863	1770	1583	3539	1770

Phasing Parameters

```
SEQUENCES       56    56
PERMISSIVES     NO    NO    NO    NO         LEADLAGS    NONE   NONE
OVERLAPS       YES   YES   YES   YES         OFFSET      0.00      1
CYCLES         110   110    10               PEDTIME      0.0      0
GREENTIMES    9.00  2.00 41.00  5.00  9.00 24.00
YELLOWTIMES   5.00  5.00  5.00  5.00  5.00  5.00
CRITICALS        9     3     8     6    12     5
EXCESS           0
```

```
Institute for Astronomy                                       01/07/04
AM Peak Hour of Traffic                                       14:01:09
Year 2006 with Phases 1 and 2

SIGNAL2000/TEAPAC[Ver 1.11.00] - Capacity Analysis Summary

Intersection Averages for Int #   0 - Kula Highway/Haleakala Highway
       Degree of Saturation (v/c) 0.90  Vehicle Delay  54.6   Level of Service D

        -------------------------------------------------
Sq 61 |  Phase 1   |  Phase 2   |  Phase 3   |  Phase 4   |
**/** -------------------------------------------------
      |     *      |            | + +        |            |
      |     *      |            | + +        |            |
 /|\  |     *>     |            |<+ +        |            <****|
  |   |            |            |   v        |      ^     ****|
  |   |            |       ^    |         ^  |++++    v       |
North |     <+     |     <* +   |         *  |++++>           |
  |   |      +     |      * +   |         *  |                |
      |      +     |      * +   |         *  |                |
      -------------------------------------------------
      | G/C=0.067  | G/C=0.089  | G/C=0.367  | G/C=0.256  |
      | G=   6.0"  | G=   8.0"  | G=  33.0"  | G=  23.0"  |
      | Y+R= 5.0"  | Y+R= 5.0"  | Y+R= 5.0"  | Y+R= 5.0"  |
      | OFF= 0.0%  | OFF=12.2%  | OFF=26.7%  | OFF=68.9%  |
      -------------------------------------------------
       C= 90 sec    G= 70.0 sec = 77.8%  Y=20.0 sec = 22.2%  Ped= 0.0 sec =  0.0%
```

Lane Group	Width/ Lanes	g/C Reqd	g/C Used	Service Rate @C (vph)	Service Rate @E	Adj Volume	v/c	HCM Delay	L S	Queue Model 1
SB Approach								44.4	D+	
RT	12/1	0.123	0.367	422	581	6	0.010	20.1	C+	6 ft
TH	12/1	0.388	0.367	546	683	589	0.862	40.3	D+	671 ft
LT	12/1	0.152	0.067	1	99	94	0.797	72.0	*E	130 ft
NB Approach								59.5	E+	
TH	12/1	0.558	0.511	846	952	944	0.992	54.4	*D	1196 ft
LT	12/1	0.287	0.211	223	371	361	0.965	73.0	*E	506 ft
WB Approach								71.9	E	
TH+LT	12/1	0.324	0.256	207	310	300	0.955	71.9	*E	424 ft
EB Approach								28.1	C	
TH+LT	12/1	0.182	0.256	330	470	178	0.379	28.1	C	172 ft

```
Institute for Astronomy                                       01/07/04
AM Peak Hour of Traffic                                       14:01:22
Year 2006 with Phases 1 and 2

SIGNAL2000/TEAPAC[Ver 1.11.00] - Summary of Parameter Values

   Intersection Parameters for Int #   0 - Kula Highway/Haleakala Highway
METROAREA            NONCBD
SIMULATION PERIOD        15
LEVELOFSERVICE        C   S
NODELOCATION          0   0
QUEUEMODELS     1  90  25  40

   Approach Parameters
APPLABELS            SB               WB               NB               EB
GRADES              0.0              0.0              0.0              0.0
PEDLEVELS             0                0                0                0
BIKEVOLUMES           0                0                0                0
PARKINGSIDES       NONE             NONE             NONE             NONE
PARKVOLUMES          20               20               20               20
BUSVOLUMES            0                0                0                0
RIGHTTURNONREDS       0                0                0                0
UPSTREAMVC         0.00             0.00             0.00             0.00

   Movement Parameters
MOVLABELS          RT   TH   LT    RT   TH   LT    RT   TH   LT    RT   TH   LT
VOLUMES             5  530   85   170  120  150   150  850  325   555  155    5
WIDTHS           12.0 12.0 12.0  12.0 12.0  0.0  12.0 12.0 12.0  12.0 12.0  0.0
LANES               1    1    1     1    1    0     1    1    1     1    1    0
GROUPTYPES       NORM NORM NORM  FFLW NORM NORM  FFLW NORM NORM  FFLW NORM NORM
UTILIZATIONS     0.00 0.00 0.00  0.00 0.00 0.00  0.00 0.00 0.00  0.00 0.00 0.00
TRUCKPERCENTS     2.0  2.0  2.0   2.0  2.0  2.0   2.0  2.0  2.0   2.0  2.0  2.0
PEAKHOURFACTORS  0.90 0.90 0.90  0.90 0.90 0.90  0.90 0.90 0.90  0.90 0.90 0.90
ARRIVALTYPES        2    2    2     3    3    3     2    2    2     3    3    3
ACTUATIONS         NO  YES  YES    NO  YES  YES    NO  YES  YES    NO  YES  YES
REQCLEARANCES     5.0  5.0  5.0   5.0  5.0  5.0   5.0  5.0  5.0   5.0  5.0  5.0
MINIMUMS          5.0  5.0  5.0   5.0  5.0  5.0   5.0  5.0  5.0   5.0  5.0  5.0
STARTUPLOST       2.0  2.0  2.0   2.0  2.0  2.0   2.0  2.0  2.0   2.0  2.0  2.0
ENDGAIN           2.0  2.0  2.0   2.0  2.0  2.0   2.0  2.0  2.0   2.0  2.0  2.0
STORAGE             0    0    0     0    0    0     0    0    0     0    0    0
INITIALQUEUE        0    0    0     0    0    0     0    0    0     0    0    0
IDEALSATFLOWS    1900 1900 1900  1900 1900 1900  1900 1900 1900  1900 1900 1900
FACTORS          1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00
DELAYFACTORS     1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00
NSTOPFACTORS     1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00  1.00 1.00 1.00
SATURATIONFLOWS  1583 1863 1770     0 1230    0     0 1863 1770     0 1839    0

   Phasing Parameters
SEQUENCES          61     61
PERMISSIVES        NO     NO     NO     NO         LEADLAGS     NONE  NONE
OVERLAPS          YES    YES    YES    YES         OFFSET       0.00     1
CYCLES             90    180     90                PEDTIME       0.0     0
GREENTIMES       6.00   8.00  33.00  23.00
YELLOWTIMES      5.00   5.00   5.00   5.00
CRITICALS           3      9      8      5
EXCESS              0
```

Institute for Astronomy
PM Peak Hour of Traffic
Year 2006 with Phases 1 and 2

01/07/04
16:15:32

SIGNAL2000/TEAPAC[Ver 1.11.00] - Capacity Analysis Summary

Intersection Averages for Int # 0 - Kula Highway/Haleakala Highway
Degree of Saturation (v/c) 0.82 Vehicle Delay 47.5 Level of Service D

```
Sq 61 | Phase 1   | Phase 2   | Phase 3   | Phase 4   |
**/** ------------------------------------------------
      |     *     |           | + *       |           |
      |     *     |           | + *       |           |
 /|\  |     *>    |           |<+ *       |    <****|
  |   |           |           |   v       |  ^  ****|
  |   |           |       ^   |       ^   |++++   v  |
North |    <+     |     <* +  |       +   |++++>     |
  |   |     +     |      * +  |       +   |          |
      |     +     |      * +  |       +   |          |
-------------------------------------------------------
      | G/C=0.058 | G/C=0.200 | G/C=0.417 | G/C=0.158 |
      | G=   7.0" | G=  24.0" | G=  50.0" | G=  19.0" |
      | Y+R= 5.0" | Y+R= 5.0" | Y+R= 5.0" | Y+R= 5.0" |
      | OFF= 0.0% | OFF=10.0% | OFF=34.2% | OFF=80.0% |
-------------------------------------------------------
      C=120 sec   G=100.0 sec = 83.3%  Y=20.0 sec = 16.7%  Ped= 0.0 sec =  0.0%
```

Lane Group	Width/ Lanes	g/C Reqd	g/C Used	Service Rate @C (vph)	Service Rate @E	Adj Volume	v/c	HCM Delay	L S	Queue Model 1
SB Approach								57.5	E+	
RT	12/1	0.251	0.417	390	660	6	0.009	23.6	C+	8 ft
TH	12/1	0.497	0.417	523	776	722	0.930	56.1	*E+	1086 ft
LT	12/1	0.270	0.058	1	77	72	0.699	74.4	*E	124 ft
NB Approach								39.6	D+	
TH	12/1	0.579	0.658	1099	1226	917	0.748	23.7	C+	1066 ft
LT	12/1	0.419	0.300	174	525	500	0.942	68.9	*E	808 ft
WB Approach								66.6	E+	
TH+LT	12/1	0.293	0.158	1	191	172	0.793	66.6	*E+	281 ft
EB Approach								45.7	D	
TH+LT	12/1	0.260	0.158	1	264	100	0.345	45.7	D	140 ft

Institute for Astronomy
PM Peak Hour of Traffic
Year 2006 with Phases 1 and 2

01/07/04
16:15:47

SIGNAL2000/TEAPAC[Ver 1.11.00] - Summary of Parameter Values

Intersection Parameters for Int # 0 - Kula Highway/Haleakala Highway

METROAREA	NONCBD		
SIMULATION PERIOD	15		
LEVELOFSERVICE	C	S	
NODELOCATION	0	0	
QUEUEMODELS	1 90	25	40

Approach Parameters

APPLABELS	SB	WB	NB	EB
GRADES	0.0	0.0	0.0	0.0
PEDLEVELS	0	0	0	0
BIKEVOLUMES	0	0	0	0
PARKINGSIDES	NONE	NONE	NONE	NONE
PARKVOLUMES	20	20	20	20
BUSVOLUMES	0	0	0	0
RIGHTTURNONREDS	0	0	0	0
UPSTREAMVC	0.00	0.00	0.00	0.00

Movement Parameters

MOVLABELS	RT	TH	LT	RT	TH	LT	RT	TH	LT	RT	TH	LT
VOLUMES	5	650	65	80	80	75	65	825	450	415	85	5
WIDTHS	12.0	12.0	12.0	12.0	12.0	0.0	12.0	12.0	12.0	12.0	12.0	0.0
LANES	1	1	1	1	1	0	1	1	1	1	1	0
GROUPTYPES	NORM	NORM	NORM	FFLW	NORM	NORM	FFLW	NORM	NORM	FFLW	NORM	NORM
UTILIZATIONS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRUCKPERCENTS	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
PEAKHOURFACTORS	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
ARRIVALTYPES	2	2	2	3	3	3	2	2	2	3	3	3
ACTUATIONS	NO	YES	YES	NO	YES	YES	NO	YES	YES	NO	YES	YES
REQCLEARANCES	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
MINIMUMS	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
STARTUPLOST	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
ENDGAIN	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
STORAGE	0	0	0	0	0	0	0	0	0	0	0	0
INITIALQUEUE	0	0	0	0	0	0	0	0	0	0	0	0
IDEALSATFLOWS	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
FACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
DELAYFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
NSTOPFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
SATURATIONFLOWS	1583	1863	1770	0	1369	0	0	1863	1770	0	1832	0

Phasing Parameters

SEQUENCES	61	61		
PERMISSIVES	NO	NO	NO	NO
OVERLAPS	YES	YES	YES	YES
CYCLES	120	120	85	
GREENTIMES	7.00	24.00	50.00	19.00
YELLOWTIMES	5.00	5.00	5.00	5.00
CRITICALS	3	9	2	5
EXCESS	0			

LEADLAGS	NONE	NONE
OFFSET	0.00	1
PEDTIME	0.0	0

```
Institute for Astronomy                                          01/07/04
AM Peak Hour of Traffic                                          14:21:12
Year 2006 with Phases 1 and 2

SIGNAL2000/TEAPAC[Ver 1.11.00] - Capacity Analysis Summary

Intersection Averages for Int #   0 - Old Haleakala Hwy/Pukalani St
      Degree of Saturation (v/c) 0.58  Vehicle Delay  17.1   Level of Service B

       ------------------------------------------
Sq  0 |  Phase 1  |  Phase 2  |  Phase 3  |
**/** ------------------------------------------
      |           |           |           |
      |           |           |           |
 /|\  |           |     <++++|     <++++|
  |   |           |      ****|      ++++|
  |   |           |      v   |      v   |
North |    <+   *>|        +>|++++>     |
  |   |++++ +   * |        + |++++      |
      |   v +   * |        + |   v      |
       ------------------------------------------
      | G/C=0.433 | G/C=0.083 | G/C=0.317 |
      | G=  26.0" | G=   5.0" | G=  19.0" |
      | Y+R= 5.0" | Y+R= 5.0" | Y+R= 0.0" |
      | OFF= 0.0% | OFF=51.7% | OFF=68.3% |
       ------------------------------------------
      C= 60 sec   G= 50.0 sec = 83.3%  Y=10.0 sec = 16.7%  Ped= 0.0 sec =  0.0%

------------------------------------------------------------------------------
| Lane   |Width/|     g/C     | Service Rate|  Adj |       |  HCM  | L | Queue |
|  Group | Lanes| Reqd   Used | @C (vph) @E |Volume|  v/c  | Delay | S |Model 1|
------------------------------------------------------------------------------
NB Approach                                                  17.2    B
==============================================================================
|  RT    | 12/1 |0.291 |0.600 |  925 |  950 |  378 |0.398 |   7.6 |*A | 169 ft|
|  LT    | 12/1 |0.392 |0.433 |  719 |  767 |  639 |0.833 |  22.9 | C+| 472 ft|
------------------------------------------------------------------------------
WB Approach                                                  21.9    C+
==============================================================================
|  TH    | 12/1 |0.182 |0.400 |  692 |  745 |  267 |0.358 |  12.9 | B+| 148 ft|
|  LT    | 12/1 |0.070 |0.083 |  409 |  461 |  383 |0.831 |  28.2 |*C | 305 ft|
------------------------------------------------------------------------------
EB Approach                                                   8.7    A
==============================================================================
|  RT    | 12/1 |0.212 |0.750 | 1188 | 1188 |  244 |0.205 |   2.6 | A |  69 ft|
|  TH    | 12/1 |0.109 |0.233 |  363 |  435 |  139 |0.320 |  19.5 | B-|  92 ft|
------------------------------------------------------------------------------
```

```
Institute for Astronomy                                          01/07/04
AM Peak Hour of Traffic                                          14:21:46
Year 2006 with Phases 1 and 2

SIGNAL2000/TEAPAC[Ver 1.11.00] - Summary of Parameter Values

   Intersection Parameters for Int #   0 - Old Haleakala Hwy/Pukalani St
METROAREA             NONCBD
SIMULATION PERIOD         15
LEVELOFSERVICE        C    S
NODELOCATION          0    0
QUEUEMODELS    1  90  25  40

   Approach Parameters
APPLABELS           SB              WB              NB              EB
GRADES             0.0             0.0             0.0             0.0
PEDLEVELS            0               0               0               0
BIKEVOLUMES          0               0               0               0
PARKINGSIDES      NONE            NONE            NONE            NONE
PARKVOLUMES         20              20              20              20
BUSVOLUMES           0               0               0               0
RIGHTTURNONREDS      0               0               0               0
UPSTREAMVC        0.00            0.00            0.00            0.00

   Movement Parameters
MOVLABELS         RT   TH   LT     RT   TH   LT     RT   TH   LT     RT   TH   LT
VOLUMES            0    0    0      0  240  345    340    0  575    220  125    0
WIDTHS           0.0  0.0  0.0    0.0 12.0 12.0   12.0  0.0 12.0   12.0 12.0  0.0
LANES              0    0    0      0    1    1      1    0    1      1    1    0
GROUPTYPES      NORM NORM NORM   NORM NORM NORM   NORM NORM NORM   NORM NORM NORM
UTILIZATIONS    0.00 0.00 0.00   0.00 0.00 0.00   0.00 0.00 0.00   0.00 0.00 0.00
TRUCKPERCENTS    2.0  2.0  2.0    2.0  2.0  2.0    2.0  2.0  2.0    2.0  2.0  2.0
PEAKHOURFACTORS 0.90 0.90 0.90   0.90 0.90 0.90   0.90 0.90 0.90   0.90 0.90 0.90
ARRIVALTYPES       3    3    3      3    3    3      3    3    3      3    3    3
ACTUATIONS        NO  YES  YES     NO  YES  YES     NO  YES  YES     NO  YES  YES
REQCLEARANCES    5.0  5.0  5.0    5.0  5.0  5.0    5.0  5.0  5.0    5.0  5.0  5.0
MINIMUMS         5.0  5.0  5.0    5.0  5.0  5.0    5.0  5.0  5.0    5.0  5.0  5.0
STARTUPLOST      2.0  2.0  2.0    2.0  2.0  2.0    2.0  2.0  2.0    2.0  2.0  2.0
ENDGAIN          2.0  2.0  2.0    2.0  2.0  2.0    2.0  2.0  2.0    2.0  2.0  2.0
STORAGE            0    0    0      0    0    0      0    0    0      0    0    0
INITIALQUEUE       0    0    0      0    0    0      0    0    0      0    0    0
IDEALSATFLOWS   1900 1900 1900   1900 1900 1900   1900 1900 1900   1900 1900 1900
FACTORS         1.00 1.00 1.00   1.00 1.00 1.00   1.00 1.00 1.00   1.00 1.00 1.00
DELAYFACTORS    1.00 1.00 1.00   1.00 1.00 1.00   1.00 1.00 1.00   1.00 1.00 1.00
NSTOPFACTORS    1.00 1.00 1.00   1.00 1.00 1.00   1.00 1.00 1.00   1.00 1.00 1.00
SATURATIONFLOWS    0    0    0      0 1863 1770   1583    0 1770   1583 1863    0
```

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Institute for Astronomy                                          01/07/04
AM Peak Hour of Traffic                                          14:21:46
Year 2006 with Phases 1 and 2

SIGNAL2000/TEAPAC[Ver 1.11.00] - Summary of Parameter Values

  Phasing Parameters
SEQUENCES            0     0
PERMISSIVES        YES   YES   YES   YES       LEADLAGS       NONE   NONE
OVERLAPS           YES   YES   YES   YES       OFFSET         0.00      1
CYCLES              60   120    10             PEDTIME         0.0      0
GREENTIMES       26.00  5.00 19.00
YELLOWTIMES       5.00  5.00  0.00
CRITICALS            7     6     2
EXCESS               0
PHASEMOVEMENTS       1     7     9    10     0     0     0
PHASEMOVEMENTS       2     6     7     5     0     0     0
PHASEMOVEMENTS       3     5    10    11    -6     0     0
PHASEMOVEMENTS       4     0     0     0     0     0     0
PHASEMOVEMENTS       5     0     0     0     0     0     0
PHASEMOVEMENTS       6     0     0     0     0     0     0
```

```
Institute for Astronomy                                          01/07/04
PM Peak Hour of Traffic                                          14:29:10
Year 2006 with Phases 1 and 2

SIGNAL2000/TEAPAC[Ver 1.11.00] - Capacity Analysis Summary

Intersection Averages for Int #   0 - Old Haleakala Hwy/Pukalani St
    Degree of Saturation (v/c) 0.66  Vehicle Delay  23.9  Level of Service C+

      -------------------------------------------
Sq  0 |  Phase 1  |  Phase 2  |  Phase 3  |
**/** -------------------------------------------
      |           |           |           |
 /|\  |           |      <++++|      <++++|
  |   |           |       ****|       ++++|
  |   |           |       v   |       v   |
North |    <+   *>|         +>|++++>      |
  |   |++++ +   * |         + |++++       |
      |   v +   * |         + |   v       |
      -------------------------------------------
      | G/C=0.217 | G/C=0.083 | G/C=0.533 |
      | G= 13.0"  | G=  5.0"  | G= 32.0"  |
      | Y+R= 5.0" | Y+R= 5.0" | Y+R= 0.0" |
      | OFF= 0.0% | OFF=30.0% | OFF=46.7% |
      -------------------------------------------
      C= 60 sec   G= 50.0 sec = 83.3%  Y=10.0 sec = 16.7%  Ped= 0.0 sec =  0.0%

-------------------------------------------------------------------------------
| Lane   |Width/|    g/C     | Service Rate| Adj  |       | HCM  | L | Queue |
| Group  | Lanes| Reqd  Used | @C (vph) @E |Volume|  v/c  | Delay| S |Model 1|
-------------------------------------------------------------------------------
NB Approach                                                    29.3   C
===============================================================================
|  RT    | 12/1 |0.345 |0.383 |  541 |  607 |  472 |0.778 |  25.7 |*C+| 354 ft|
|  LT    | 12/1 |0.216 |0.217 |  312 |  383 |  311 |0.812 |  34.8 | C | 261 ft|
-------------------------------------------------------------------------------
WB Approach                                                    34.9   C
===============================================================================
|  TH    | 12/1 |0.163 |0.617 | 1136 | 1149 |  233 |0.203 |   5.1 | A |  83 ft|
|  LT    | 12/1 |0.097 |0.083 |  601 |  632 |  628 |0.994 |  45.9 |*D | 632 ft|
-------------------------------------------------------------------------------
EB Approach                                                     6.3   A
===============================================================================
|  RT    | 12/1 |0.370 |0.750 | 1188 | 1188 |  517 |0.435 |   3.9 | A | 172 ft|
|  TH    | 12/1 |0.182 |0.450 |  793 |  838 |  267 |0.319 |  10.8 | B+| 136 ft|
-------------------------------------------------------------------------------
```

Institute for Astronomy
PM Peak Hour of Traffic
Year 2006 with Phases 1 and 2

01/07/04
14:29:19

SIGNAL2000/TEAPAC[Ver 1.11.00] - Summary of Parameter Values

Intersection Parameters for Int # 0 - Old Haleakala Hwy/Pukalani St

METROAREA	NONCBD			
SIMULATION PERIOD	15			
LEVELOFSERVICE	C	B		
NODELOCATION	0	0		
QUEUEMODELS	1	90	25	40

Approach Parameters

APPLABELS	SB	WB	NB	EB
GRADES	0.0	0.0	0.0	0.0
PEDLEVELS	0	0	0	0
BIKEVOLUMES	0	0	0	0
PARKINGSIDES	NONE	NONE	NONE	NONE
PARKVOLUMES	20	20	20	20
BUSVOLUMES	0	0	0	0
RIGHTTURNONREDS	0	0	0	0
UPSTREAMVC	0.00	0.00	0.00	0.00

Movement Parameters

MOVLABELS	RT	TH	LT	RT	TH	LT	RT	TH	LT	RT	TH	LT
VOLUMES	0	0	0	0	210	565	425	0	280	465	240	0
WIDTHS	0.0	0.0	0.0	0.0	12.0	12.0	12.0	0.0	12.0	12.0	12.0	0.0
LANES	0	0	0	0	1	1	1	0	1	1	1	0
GROUPTYPES	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM
UTILIZATIONS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRUCKPERCENTS	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
PEAKHOURFACTORS	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
ARRIVALTYPES	3	3	3	3	3	3	3	3	3	3	3	3
ACTUATIONS	NO	YES	YES	NO	YES	YES	NO	YES	YES	NO	YES	YES
REQCLEARANCES	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
MINIMUMS	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
STARTUPLOST	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
ENDGAIN	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
STORAGE	0	0	0	0	0	0	0	0	0	0	0	0
INITIALQUEUE	0	0	0	0	0	0	0	0	0	0	0	0
IDEALSATFLOWS	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
FACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
DELAYFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
NSTOPFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
SATURATIONFLOWS	0	0	0	0	1863	1770	1583	0	1770	1583	1863	0

Institute for Astronomy
PM Peak Hour of Traffic
Year 2006 with Phases 1 and 2

01/07/04
14:29:19

SIGNAL2000/TEAPAC[Ver 1.11.00] - Summary of Parameter Values

Phasing Parameters

SEQUENCES	0	0					
PERMISSIVES	YES	YES	YES	YES			
OVERLAPS	YES	YES	YES	YES			
CYCLES	60	120	10				
GREENTIMES	13.00	5.00	32.00				
YELLOWTIMES	5.00	5.00	0.00				
CRITICALS	7	6	2				
EXCESS	0						
PHASEMOVEMENTS	1	7	9	10	0	0	0
PHASEMOVEMENTS	2	6	7	5	0	0	0
PHASEMOVEMENTS	3	5	10	11	-6	0	0
PHASEMOVEMENTS	4	0	0	0	0	0	0
PHASEMOVEMENTS	5	0	0	0	0	0	0
PHASEMOVEMENTS	6	0	0	0	0	0	0

LEADLAGS	NONE	NONE
OFFSET	0.00	1
PEDTIME	0.0	0

Institute for Astronomy
AM Peak Hour of Traffic
Year 2006 with Phases 1 and 2

01/07/04
14:18:12

SIGNAL2000/TEAPAC[Ver 1.11.00] - Capacity Analysis Summary

Intersection Averages for Int # 0 - Old Haleakala Highway/Makawao
Degree of Saturation (v/c) 0.60 Vehicle Delay 17.6 Level of Service B

```
        ----------------------------------------
Sq  0 |  Phase 1  |  Phase 2  |  Phase 3  |
**/** ----------------------------------------
      | + * *     |           |        ^  |
      | + * *     |           |     ****|
 /|\  |<+ * *>    |           |    <****|
  |   |   v       |      ^    |   ^  ****|
  |   |       ^   |++++       |++++   v   |
North |   <+ + +> |++++>      |++++>      |
  |   |    + + +  |++++       |++++       |
      |    + + +  |    v      |   v       |
        ----------------------------------------
      | G/C=0.300 | G/C=0.050 | G/C=0.400 |
      | G=  18.0" | G=   3.0" | G=  24.0" |
      | Y+R= 5.0" | Y+R= 5.0" | Y+R= 5.0" |
      | OFF= 0.0% | OFF=38.3% | OFF=51.7% |
        ----------------------------------------
      C= 60 sec   G= 45.0 sec = 75.0%  Y=15.0 sec = 25.0%  Ped= 0.0 sec =  0.0%
```

Lane Group	Width/ Lanes	g/C Reqd	g/C Used	Service Rate @C (vph)	Service Rate @E	Adj Volume	v/c	HCM Delay	L S	Queue Model 1
SB Approach								20.3	C+	
RT	12/1	0.219	0.300	395	475	256	0.539	21.9	C+	180 ft
TH+LT	12/1	0.132	0.300	298	357	105	0.294	16.6	*B	66 ft
NB Approach								24.5	C+	
RT+TH+LT	12/1	0.261	0.300	427	492	361	0.734	24.5	C+	271 ft
WB Approach								21.0	C+	
RT+TH+LT	12/1	0.343	0.400	592	646	494	0.765	21.0	*C+	353 ft
EB Approach								9.4	A	
RT+TH	12/1	0.326	0.533	957	987	539	0.546	9.9	A	280 ft
LT	12/1	0.084	0.533	913	944	94	0.100	6.9	A	37 ft

Institute for Astronomy
AM Peak Hour of Traffic
Year 2006 with Phases 1 and 2

01/07/04
14:18:26

SIGNAL2000/TEAPAC[Ver 1.11.00] - Summary of Parameter Values

Intersection Parameters for Int # 0 - Old Haleakala Highway/Makawao

METROAREA	NONCBD			
SIMULATION PERIOD	15			
LEVELOFSERVICE	C	S		
NODELOCATION	0	0		
QUEUEMODELS	1	90	25	40

Approach Parameters

APPLABELS	SB	WB	NB	EB
GRADES	0.0	0.0	0.0	0.0
PEDLEVELS	0	0	0	0
BIKEVOLUMES	0	0	0	0
PARKINGSIDES	NONE	NONE	NONE	NONE
PARKVOLUMES	20	20	20	20
BUSVOLUMES	0	0	0	0
RIGHTTURNONREDS	0	0	0	0
UPSTREAMVC	0.00	0.00	0.00	0.00

Movement Parameters

MOVLABELS	RT	TH	LT	RT	TH	LT	RT	TH	LT	RT	TH	LT
VOLUMES	230	40	55	65	325	55	215	80	30	20	465	85
WIDTHS	12.0	12.0	0.0	0.0	12.0	0.0	0.0	12.0	0.0	0.0	12.0	12.0
LANES	1	1	0	0	1	0	0	1	0	0	1	1
GROUPTYPES	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM
UTILIZATIONS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRUCKPERCENTS	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
PEAKHOURFACTORS	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
ARRIVALTYPES	3	3	3	3	3	3	3	3	3	3	3	3
ACTUATIONS	NO	YES	YES	NO	YES	YES	NO	YES	YES	NO	YES	YES
REQCLEARANCES	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
MINIMUMS	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
STARTUPLOST	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
ENDGAIN	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
STORAGE	0	0	0	0	0	0	0	0	0	0	0	0
INITIALQUEUE	0	0	0	0	0	0	0	0	0	0	0	0
IDEALSATFLOWS	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
FACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
DELAYFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
NSTOPFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
SATURATIONFLOWS	1583	1189	0	0	1615	0	0	1639	0	0	1851	1770

Institute for Astronomy
AM Peak Hour of Traffic
Year 2006 with Phases 1 and 2

01/07/04
14:18:26

SIGNAL2000/TEAPAC[Ver 1.11.00] - Summary of Parameter Values

Phasing Parameters										
SEQUENCES	0	0								
PERMISSIVES	NO	NO	NO	NO			LEADLAGS	NONE	NONE	
OVERLAPS	YES	YES	YES	YES			OFFSET	0.00	1	
CYCLES	60	120	10				PEDTIME	0.0	0	
GREENTIMES	18.00	3.00	24.00							
YELLOWTIMES	5.00	5.00	5.00							
CRITICALS	2	6	5							
EXCESS	0									
PHASEMOVEMENTS	1	1	2	3	7	8	9			
PHASEMOVEMENTS	2	10	11	12	0	0	0			
PHASEMOVEMENTS	3	4	5	6	10	11	12			
PHASEMOVEMENTS	4	0	0	0	0	0	0			
PHASEMOVEMENTS	5	0	0	0	0	0	0			
PHASEMOVEMENTS	6	0	0	0	0	0	0			

Institute for Astronomy
PM Peak Hour of Traffic
Year 2006 with Phases 1 and 2

01/07/04
14:20:07

SIGNAL2000/TEAPAC[Ver 1.11.00] - Capacity Analysis Summary

Intersection Averages for Int # 0 - Old Haleakala Highway/Makawao
Degree of Saturation (v/c) 0.63 Vehicle Delay 22.2 Level of Service C+

```
         --------------------------------------
Sq  0 |  Phase 1  |  Phase 2  |  Phase 3  |
**/** --------------------------------------
      | + * *     |           |       ^   |
  .   | + * *     |           |      ****|
 /|\  |<+ * *>    |           |     <****|
  |   |   v       |     ^     |   ^  ****|
  |   |       ^   |++++       |++++  v   |
North |    <+ + +>|++++>      |++++>     |
  |   |     + + + |++++       |++++      |
      |     + + + |    v      |   v      |
      --------------------------------------
      | G/C=0.300 | G/C=0.050 | G/C=0.400 |
      | G=  18.0" | G=   3.0" | G=  24.0" |
      | Y+R= 5.0" | Y+R= 5.0" | Y+R= 5.0" |
      | OFF= 0.0% | OFF=38.3% | OFF=51.7% |
      --------------------------------------
      C= 60 sec   G= 45.0 sec = 75.0%  Y=15.0 sec = 25.0%  Ped= 0.0 sec =  0.0%
```

Lane Group	Width/ Lanes	g/C Reqd	g/C Used	Service Rate @C (vph)	Service Rate @E	Adj Volume	v/c	HCM Delay	L S	Queue Model 1
SB Approach								31.5	C	
RT	12/1	0.303	0.300	395	475	400	0.842	36.1	D+	340 ft
TH+LT	12/1	0.120	0.300	387	450	122	0.271	16.3	*B	75 ft
NB Approach								16.2	B	
RT+TH+LT	12/1	0.112	0.300	440	505	128	0.253	16.2	B	78 ft
WB Approach								33.2	C	
RT+TH+LT	12/1	0.396	0.400	625	679	617	0.909	33.2	*C	520 ft
EB Approach								8.7	A	
RT+TH	12/1	0.276	0.533	952	982	439	0.447	8.9	A	213 ft
LT	12/1	0.250	0.533	913	944	372	0.394	8.5	A	175 ft

Institute for Astronomy
PM Peak Hour of Traffic
Year 2006 with Phases 1 and 2

01/07/04
14:20:16

SIGNAL2000/TEAPAC[Ver 1.11.00] - Summary of Parameter Values

Intersection Parameters for Int # 0 - Old Haleakala Highway/Makawao

METROAREA	NONCBD				
SIMULATION PERIOD	15				
LEVELOFSERVICE	C	S			
NODELOCATION	0	0			
QUEUEMODELS	1	90	25	40	

Approach Parameters

APPLABELS	SB	WB	NB	EB
GRADES	0.0	0.0	0.0	0.0
PEDLEVELS	0	0	0	0
BIKEVOLUMES	0	0	0	0
PARKINGSIDES	NONE	NONE	NONE	NONE
PARKVOLUMES	20	20	20	20
BUSVOLUMES	0	0	0	0
RIGHTTURNONREDS	0	0	0	0
UPSTREAMVC	0.00	0.00	0.00	0.00

Movement Parameters

MOVLABELS	RT	TH	LT	RT	TH	LT	RT	TH	LT	RT	TH	LT
VOLUMES	360	55	55	70	435	50	35	60	20	30	365	335
WIDTHS	12.0	12.0	0.0	0.0	12.0	0.0	0.0	12.0	0.0	0.0	12.0	12.0
LANES	1	1	0	0	1	0	0	1	0	0	1	1
GROUPTYPES	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM
UTILIZATIONS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRUCKPERCENTS	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
PEAKHOURFACTORS	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
ARRIVALTYPES	3	3	3	3	3	3	3	3	3	3	3	3
ACTUATIONS	NO	YES	YES	NO	YES	YES	NO	YES	YES	NO	YES	YES
REQCLEARANCES	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
MINIMUMS	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
STARTUPLOST	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
ENDGAIN	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
STORAGE	0	0	0	0	0	0	0	0	0	0	0	0
INITIALQUEUE	0	0	0	0	0	0	0	0	0	0	0	0
IDEALSATFLOWS	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
FACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
DELAYFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
NSTOPFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
SATURATIONFLOWS	1583	1501	0	0	1696	0	0	1684	0	0	1842	1770

Institute for Astronomy
PM Peak Hour of Traffic
Year 2006 with Phases 1 and 2

01/07/04
14:20:16

SIGNAL2000/TEAPAC[Ver 1.11.00] - Summary of Parameter Values

Phasing Parameters

SEQUENCES	0	0					
PERMISSIVES	NO	NO	NO	NO			
OVERLAPS	YES	YES	YES	YES			
CYCLES	60	120	10				
GREENTIMES	18.00	3.00	24.00				
YELLOWTIMES	5.00	5.00	5.00				
CRITICALS	2	6	5				
EXCESS	0						
PHASEMOVEMENTS	1	1	2	3	7	8	9
PHASEMOVEMENTS	2	10	11	12	0	0	0
PHASEMOVEMENTS	3	4	5	6	10	11	12
PHASEMOVEMENTS	4	0	0	0	0	0	0
PHASEMOVEMENTS	5	0	0	0	0	0	0
PHASEMOVEMENTS	6	0	0	0	0	0	0

LEADLAGS	NONE	NONE
OFFSET	0.00	1
PEDTIME	0.0	0

CHAPTER 17 - TWSC - UNSIGNALIZED INTERSECTIONS WORKSHEET

Analysis Summary

General Information | **Site Information**

Analyst	TL	Jurisdiction/Date	KULA, MAUI 1/7/2004
Agency or Company	ATA	Major Street	KULA HWY
Analysis Period/Year	AM PEAK HOUR 2006	Minor Street	KKHS DRWY
Comment	YEAR 2006 WITH PHASE 1 AND PHASE 2		

Input Data

Lane Configuration	SB			NB			EB			WB		
Lane 1 (curb)	TR			R			LTR			R		
Lane 2	L			LT						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)	230	965	5	5	1180	130	5	0	5	20		125
PHF	.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
Flow rate	256	1072	6	6	1311	144	6	0	6	22		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
EB	1	LTR	13	2	5.286	3	4533.3	F	4533.3
	2								F
	3								
WB	1	R	125	193	.647	4	52.6	F	459.4
	2	L	22	5	4.214	4	2770.4	F	F
	3								
		1	256	462	.554	3	22	C	
		4	6	643	.009	<1	10.6	B	

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CHAPTER 17 - TWSC - UNSIGNALIZED INTERSECTIONS WORKSHEET

Analysis Summary

General Information | **Site Information**

Analyst	TL	Jurisdiction/Date	KULA, MAUI 1/7/2004
Agency or Company	ATA	Major Street	KULA HWY
Analysis Period/Year	PM PEAK HOUR 2006	Minor Street	KKHS DRWY
Comment	YEAR 2006 WITH PHASE 1 AND PHASE 2		

Input Data

Lane Configuration	SB			NB			EB			WB		
Lane 1 (curb)	TR			R			LTR			R		
Lane 2	L			LT						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)	20	1130	5	5	1295	5	5	0	5	10		30
PHF	.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
Flow rate	22	1256	6	6	1439	6	6	0	6	11		33
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
EB	1	LTR	13	17	.747	2	424.5	F	424.5
	2								F
	3								
WB	1	R	33	162	.203	1	32.8	D	194.8
	2	L	11	11	.962	2	680.8	F	F
	3								
		1	22	466	.048	<1	13.1	B	
		4	6	548	.01	<1	11.6	B	

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Institute for Astronomy
Year 2006 with Phases 1 and 2
AM Peak Hour of Traffic

01/07/04
13:29:28

SIGNAL2000/TEAPAC[Ver 1.11.00] - Capacity Analysis Summary

Intersection Averages for Int # 0 - Kula Hwy/A'Apuso Pkwy
Degree of Saturation (v/c) 0.66 Vehicle Delay 21.6 Level of Service C+

```
       -------------------------
Sq 11 |  Phase 1   |  Phase 2  |
**/** -------------------------
      | + +        | +         |
  .   | + +        | +         |
 /|\  |<+ +        |<+         |
  |   |   v        |    ^      |
  |   |       ^    |****       |
North |    <+ *    |           |
  |   |     + *    |++++       |
      |     + *    |    v      |
      -------------------------
      | G/C=0.589  | G/C=0.300 |
      | G=  53.0"  | G=  27.0" |
      | Y+R= 5.0"  | Y+R= 5.0" |
      | OFF= 0.0%  | OFF=64.4% |
      -------------------------
      C= 90 sec   G= 80.0 sec = 88.9%  Y=10.0 sec = 11.1%  Ped= 0.0 sec =  0.0%
```

Lane Group	Width/ Lanes	g/C Reqd	g/C Used	Service Rate @C (vph)	Service Rate @E	Adj Volume	v/c	HCM Delay	L S	Queue Model 1
SB Approach								7.2	A	
RT	12/1	0.459	1.000	1583	1583	594	0.375	0.7	A	45 ft
TH	12/1	0.350	0.589	1009	1097	511	0.466	14.7	B+	420 ft
NB Approach								27.3	C+	
TH	12/1	0.574	0.589	1049	1097	1017	0.927	29.9	*C	1092 ft
LT	12/1	0.350	0.589	334	382	161	0.421	10.9	B+	110 ft
EB Approach								38.8	D+	
RT	12/1	0.182	0.300	320	475	94	0.198	24.4	C+	89 ft
LT	12/1	0.322	0.300	405	531	450	0.847	41.8	*D+	519 ft

Institute for Astronomy
Year 2006 with Phases 1 and 2
AM Peak Hour of Traffic

01/07/04
13:29:39

SIGNAL2000/TEAPAC[Ver 1.11.00] - Summary of Parameter Values

Intersection Parameters for Int # 0 - Kula Hwy/A'Apuso Pkwy

METROAREA	NONCBD			
SIMULATION PERIOD	15			
LEVELOFSERVICE	C	8		
NODELOCATION	0	0		
QUEUEMODELS	1	90	25	40

Approach Parameters

APPLABELS	SB	WB	NB	EB
GRADES	0.0	0.0	0.0	0.0
PEDLEVELS	0	0	0	0
BIKEVOLUMES	0	0	0	0
PARKINGSIDES	NONE	NONE	NONE	NONE
PARKVOLUMES	20	20	20	20
BUSVOLUMES	0	0	0	0
RIGHTTURNONREDS	0	0	0	0
UPSTREAMVC	0.00	0.00	0.00	0.00

Movement Parameters

MOVLABELS	RT	TH	LT	RT	TH	LT	RT	TH	LT	RT	TH	LT
VOLUMES	535	460	0	0	0	0	0	915	145	85	0	405
WIDTHS	12.0	12.0	0.0	0.0	0.0	0.0	0.0	12.0	12.0	12.0	0.0	12.0
LANES	1	1	0	0	0	0	0	1	1	1	0	1
GROUPTYPES	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM
UTILIZATIONS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRUCKPERCENTS	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
PEAKHOURFACTORS	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
ARRIVALTYPES	2	2	2	3	3	3	3	3	3	3	3	3
ACTUATIONS	NO	YES	YES	NO	YES	YES	NO	YES	YES	NO	YES	YES
REQCLEARANCES	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
MINIMUMS	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
STARTUPLOST	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
ENDGAIN	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
STORAGE	0	0	0	0	0	0	0	0	0	0	0	0
INITIALQUEUE	0	0	0	0	0	0	0	0	0	0	0	0
IDEALSATFLOWS	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
FACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
DELAYFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
NSTOPFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
SATURATIONFLOWS	1583	1863	0	0	0	0	0	1863	649	1583	0	1770

Phasing Parameters

SEQUENCES	11	11		
PERMISSIVES	NO	NO	NO	NO
OVERLAPS	YES	YES	YES	YES
CYCLES	90	180	90	
GREENTIMES	53.00	27.00		
YELLOWTIMES	5.00	5.00		
CRITICALS	8	12		
EXCESS	0			

LEADLAGS	NONE	NONE
OFFSET	0.00	1
PEDTIME	0.0	0

Institute for Astronomy
Year 2006 with Phases 1 and 2
PM Peak Hour of Traffic

01/07/04
13:30:25

SIGNAL2000/TEAPAC[Ver 1.11.00] - Capacity Analysis Summary

Intersection Averages for Int # 0 - Kula Hwy/A'Apuso Pkwy
Degree of Saturation (v/c) 0.80 Vehicle Delay 38.4 Level of Service D+

```
        -------------------------
Sq 11 | Phase 1  |  Phase 2  |
**/** -------------------------
      | + *      | +         |
      | + *      | +         |
 /|\  |<+ *      |<+         |
  |   |   v      |     ^     |
  |   |        ^ |****       |
North |    <+ +  |           |
  |   |     + +  |++++       |
      |     + +  |   v       |
        -------------------------
      | G/C=0.435 | G/C=0.447 |
      | G= 37.0"  | G= 38.0"  |
      | Y+R= 5.0" | Y+R= 5.0" |
      | OFF= 0.0% | OFF=49.4% |
        -------------------------
```

C= 85 sec G= 75.0 sec = 88.2% Y=10.0 sec = 11.8% Ped= 0.0 sec = 0.0%

Lane Group	Width/ Lanes	g/C Reqd	g/C Used	Service Rate @C (vph)	Service Rate @E	Adj Volume	v/c	HCM Delay	L S	Queue Model 1
SB Approach								34.7	C	
RT	12/1	0.360	1.000	1583	1583	450	0.284	0.5	A	29 ft
TH	12/1	0.472	0.435	728	811	806	0.994	53.9	*D	1004 ft
NB Approach								30.7	C	
TH	12/1	0.401	0.435	728	811	656	0.809	27.1	C+	630 ft
LT	12/1	0.509	0.435	58	78	72	0.818	64.2	E+	91 ft
EB Approach								49.6	D	
RT	12/1	0.181	0.447	616	708	117	0.165	14.5	B+	85 ft
LT	12/1	0.486	0.447	712	791	789	0.997	54.8	*D	993 ft

Institute for Astronomy
Year 2006 with Phases 1 and 2
PM Peak Hour of Traffic

01/07/04
13:30:36

SIGNAL2000/TEAPAC[Ver 1.11.00] - Summary of Parameter Values

Intersection Parameters for Int # 0 - Kula Hwy/A'Apuso Pkwy

METROAREA	NONCBD			
SIMULATION PERIOD	15			
LEVELOFSERVICE	C	S		
NODELOCATION	0	0		
QUEUEMODELS	1	90	25	40

Approach Parameters

APPLABELS	SB	WB	NB	EB
GRADES	0.0	0.0	0.0	0.0
PEDLEVELS	0	0	0	0
BIKEVOLUMES	0	0	0	0
PARKINGSIDES	NONE	NONE	NONE	NONE
PARKVOLUMES	20	20	20	20
BUSVOLUMES	0	0	0	0
RIGHTTURNONREDS	0	0	0	0
UPSTREAMVC	0.00	0.00	0.00	0.00

Movement Parameters

MOVLABELS	RT	TH	LT	RT	TH	LT	RT	TH	LT	RT	TH	LT
VOLUMES	405	725	0	0	0	0	0	590	65	105	0	710
WIDTHS	12.0	12.0	0.0	0.0	0.0	0.0	0.0	12.0	12.0	12.0	0.0	12.0
LANES	1	1	0	0	0	0	0	1	1	1	0	1
GROUPTYPES	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM
UTILIZATIONS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRUCKPERCENTS	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
PEAKHOURFACTORS	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
ARRIVALTYPES	3	3	3	3	3	3	3	3	3	3	3	3
ACTUATIONS	NO	YES	YES	NO	YES	YES	NO	YES	YES	NO	YES	YES
REQCLEARANCES	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
MINIMUMS	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
STARTUPLOST	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
ENDGAIN	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
STORAGE	0	0	0	0	0	0	0	0	0	0	0	0
INITIALQUEUE	0	0	0	0	0	0	0	0	0	0	0	0
IDEALSATFLOWS	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
FACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
DELAYFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
NSTOPFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
SATURATIONFLOWS	1583	1863	0	0	0	0	0	1863	201	1583	0	1770

Phasing Parameters

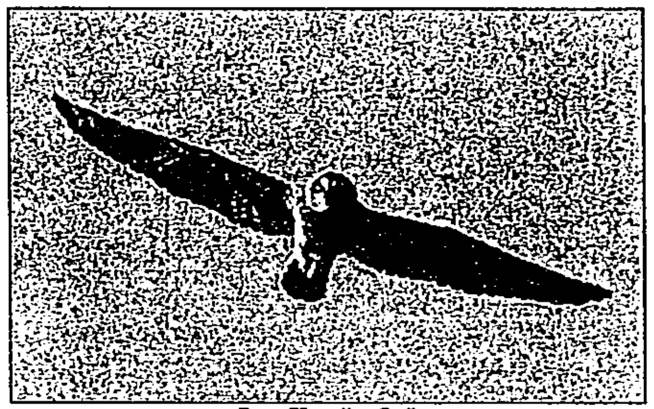
SEQUENCES	11	ALL					
PERMISSIVES	NO	NO	NO	NO	LEADLAGS	NONE	NONE
OVERLAPS	YES	YES	YES	YES	OFFSET	0.00	1
CYCLES	85	85	10		PEDTIME	0.0	0
GREENTIMES	37.00	38.00					
YELLOWTIMES	5.00	5.00					
CRITICALS	2	12					
EXCESS	0						

Appendix D

Cultural Impact Assessment

'A'apueo I Ka La'i

'A'apueo In Tranquility



Pueo (Hawaiian Owl)
Asio flammeus sandwicensis

The University of Hawaii
Institute For Advanced Technology Astronomy
3.425 acre site
Kulamalu Town Center, 'A'apueo, Maui, Hawaii

NO IMPACT

MAY 2003

Prepared for:
KULA MALU SCIENCE L.L.C.
2005 Main Street, Wailuku, Hawaii
96763 ° (808) 2441500

CKM Cultural Resources
Kahu Charles Kauluwehi Maxwell Sr.
157 Alea Place
Pukalani, Maui, Hawai'i 96798

'A'apueo I Ka La'i

'A'apueo In Tranquility

TITLE PAGE

May 2003

The University of Hawai'i
Institute For Advanced Technology Astronomy
Kulamalu Town Center, 'A'apueo[1], Maui, Hawai'i
Tax Key #2-3-008:38, 3.425 acre site

Final Copy

No Impact

[1] 'A'apueo is a female goddess of all the owl 'aumakua (personal god). W.H. Uaua, The Legend of the Battle of the Owls, *KeAu Okoa*, June 29 1871, 2. MS SC. Sterling 3.12.3.

'A'apueo I Ka La'i
'A'apueo In Tranquility

TABLE OF CONTENTS

'A'apueo I Ka La'i
'A'apueo In Tranquility

ABSTRACT

CKM Cultural Resources conducted a Hawaiian Cultural Resource Evaluation for the University of Hawai'i's Institute for Advanced Technology Astronomy, at the Kulamalu Town Center, 'A'apueo[1], Maui, Hawai'i, Tax Map Key #2-3-008:38, 3.425 acre site.

This study is in accordance with The Office of Environmental Quality Control, which describes resources having Hawaiian Cultural Value. It will describe potential impacts from further development, along with measures that could possibly be employed to mitigate those impacts. The study will evaluate the cultural significance of historic and prehistoric resources identified during an archaeological survey and assist in the development of a general preservation plan for those resources. It will also address the requirements of the Office of Hawaiian Affairs, in regards to cultural impacts. Specifically, the document will address potential affects on the Hawaiian Culture and Traditional Customary Rights as described in the legislation known as Act 50, Sessions Laws of Hawai'i, 2002.

A Hawaiian Cultural Resource Evaluation of this area revealed that it is located in an area called 'A'apueo, which is in between two prominent gulches. One gulch is called Kaluapulani [2], which is on the Makawao side of the project area, and the other gulch is called Kalialinui[3]. The project site is located within the Kulamalu Town Center, an area of approximately 3.425 acres.

Traditionally, Maui was divided into twelve (12) Ahupua'a[4](Political District today), with nine of these Ahupua'a located in East Maui. The districts of Kahikinui, Honua'ula, and Kula were identified as lands that were used for agricultural fields, which were planted in the late Hawaiian history (Kolb 1991). In the "Ruling Chiefs of Hawai'i", by Samuel Kamakau, it mentions that Kiha-a-Piilani, the son of King Piilani lived in the area under study, and he had the best sweet potato patch in the upcountry area.[5]

---

[1] 'A'apueo is a female goddess of all the owl 'aumakua(personal god). W.H. Uaua, "The Legend of the Battle of the Owls". *KeAu Okoa*, June 29 1871, 2. MS SC. Sterling 3.12.3.
[2] Kaluapulani is a gulch on the Makawao side of the project, containing numerous petroglyphs.
[3] Kalialinui, is a gulch located on the Kula side of this project. It too contains petroglyphs and other important cultural features. (Refer to Archaeological Reconnaissance Survey, submitted by PHRI, Feb. 1996.
[4] Ahupua'a is a land division usually extending from the uplands to the sea, so called because the boundary was marked by a heap (*ahu*) of stones surmounted an image of a pig (*pua'a*).
[5] Ruling Chiefs of Hawai'i, page 24 & 25, speaks about the sweet potato patches of Kiha-a-Piilani.

E.G. Handy (Handy 1940; 161) notes that, "Kula was always an arid region, throughout its long, low seashore, vast stony Kula lands, and broad uplands". Kula land is described by Handy and Handy (1972; 510) as, "open country, or plain, as distinct from valley....and has often been used as a term to distinguish between dry or Kula land and wet-taro land".

During pre-contact times, lands in the Kula district were utilized for farming. In the uplands, dry land (non-irrigated) taro patches grew up to an altitude of 3,000 feet (Handy and Handy 1972:337). While sweet potato crops grew well when the conditions were right, frequent setbacks occurred in the form of grubs, caterpillars, blight, frost, or too much sun, and the people were then burdened with famine. "During these times, they were forced to subsist on "laulele, pualele, popolo and other weeds" (Kamakau 1992:23).

Traditional Hawaiian agriculture was labor intensive and relatively restricted in the less then ideal environment of Kula. However, with the increased demand for provisions for the whaling industry, and later the gold miners in California, Kula experienced an increase in cultivation.

Kuykendall (1968) (1):313) describes the period when Kula farming transitioned from subsistence crops to commodities; "Before that time the whalers created a limited market for fresh meat, and fruit; the great increase in the number of whale ships after 1840 caused a corresponding increase in the demand for such products of the soil. In bulk and value, potatoes (sweet and Irish) ranked first in this traffic". Jarvis describes the region as it appeared to him in July 1846; "It ranges along the mountain (Haleakala) between 2,000 and 5,000 feet elevation, for the distance of 12 miles. The forest is but partially cleared, and the seed put into the rich virgin soil. The crop now in the ground is immense. The fields being all in blossom have a fine appearance, spreading as they do, over the broad surface of the mountain."

From Kula, the potatoes were carried down to the store, and taken to Lahaina, or were sold directly to ships which called at Kalepolepo. The influx of gold prospectors, together with the absence of agriculture in California, created a demand for potatoes and other vegetables, as well as for sugar, molasses and coffee. C. Speakmen (1978), in his book "MOWEE", describes the fervor of cash cropping: "During the gold rush, hundreds of Hawaiians were going into business for themselves on Maui growing potatoes and hauling them to the port where they were snapped up and shipped to San Francisco. The Maui fields were called Nu Caliponi or New California; potatoes were gold, and a fortune could be dug out of the ground by one man. The potato boom was short lived and, when the prices dropped, the Hawaiians lost interest." (Speakman 1978:116)

During the 1840's, Chinese farmers leased land in Kula. In addition to Irish potatoes, the Kula farmers planted corn, beans, onion, Chinese cabbage, round cabbage, sweet potatoes, wheat, other grains, and even cotton. Their initial success compelled many more Chinese to move to the region and lease land for farming. In

addition to the influx from other parts of the island, they came to Kula from Honolulu and Kohala (on the island of Hawai'i). Much of the land was owned by the Hawaiian government, who in turn leased it to the ranchers, who then subleased it to the Chinese. In some instances, farmers made their lease payment in farm produce in lieu of monetary transactions.

While the demand for Kula potatoes had diminished by the mid-1850's, the Chinese population continued to grow. For a period of 30 to 40 years, Kula supported a thriving community which included Chinese and English Schools, Christian churches, a Chinese Society, gambling joints, opium dens, general stores, and dozens of operating farms and cattle ranches (Mark 1976).

By the 1880's, sections of lower Kula had largely become pasture for the booming cattle industry. Large sections of crown land were leased for grazing (Silva IN Miura 1962). In 1911, the Hawaiian government released a large amount of public land, and it became possible for citizens to purchase property in Kula. During the 1910's and 1920's, many families left Kula for various reasons, such as: severe drought which devastated crops and livestock, soil which was reaching depletion levels after years of harvesting and tilling, lack of educational opportunities for their children, and loss of land due to parceling homesteads. Later, during the 20th Century, lands in the project area were primarily utilized for pasture and pineapple cultivation. No cultivation of any kind has taken place at the study site for about 25 years. There are still remnants of the old pineapple roads and furrows where the plants once grew.

Note: As much as possible, throughout this report, the spelling of Hawaiian vocabulary and place names have been standardized to present orthography.

'A'apueo I Ka La'i

'A'apueo In Tranquility

OUTLINE

I. Introduction
  a. Scope

II. Specific Area of Research
  a. 'A'apueo
    1. Clarification of area.
  b. Surrounding 'ili within Kula

III. 'A'apueo: The Historical and The Cultural Context
  a. 'A'apueo: The female deity.
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    1. Native plant growth
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IV. Conclusion

V. Bibliography

'A'apueo I Ka La'i

'A'apueo In Tranquility

INTRODUCTION

MAY 2003

INTRODUCTION – *EIA KA LĀ HIKI*

Scope:

The scope of this report will be to compile various historical, cultural, and topographical accounts and facts of 'A'apueo and its adjacent *ahupua'a*.[1] With only a few exceptions, direct references to 'A'apueo are meager. Therefore, the following description of the project area is derived from topographical, cultural, and usage descriptions of the more general areas of Kula. The report will be;

(1) In accordance with O.E.Q.C. guidelines, the study will describe resources having cultural value, and will describe potential impacts from further development along with measures that could be employed to mitigate those impacts. The contractor will coordinate with the archeologist characterizing the site to evaluate the cultural significance of historic and prehistoric resources identified during an archeological inventory, and will assist in the development of a general preservation plan for those resources.

(2) It will also include a Traditional Practices Assessment that will meet the assessment requirements of O.E.Q.C. and O.H.A. for cultural impacts. Specifically, the document will address potential effects on Hawai'i's culture, and traditional and customary rights, as described in the legislation known as Act 50, 2000.

Specific Area of Research:

This project site shall be identified as Lot Numbers 15, 16, and 17 of TMK 2-3-08: 38 and 39 (portion). These said lots reside in the ahupua'a of Kula and in the *'ili*[2] of 'A'apueo.

'A'apueo: 'A'apueo is a unique 'ili, and has a distinct topographical position. 'A'apueo is nestled on ridges, which would have made this area a safe area to live.

[1] 'Ahupua'a: Land divisions. Much of the information of this compilation will also derive from the adjacent land divisions due to the lack of written and contextual information based on various written and noted sources.
[2] 'Ili: Land section within a specific land division.

A kahuna once lived in 'A'apueo, and his sole responsibility was to protect a heiau that was built on Pu'upane hill, in the Kula ahupua'a. While Kihapi'ilani and his wife stayed at 'A'apueo, they came in contact with this kahuna, who then gave the King and Queen a tour of the ahupua'a.

Many surrounding 'ili within Kula are either adjacent or perpendicular to the said property.

Surrounding 'Ili within Kula:

There are many 'ili within the ahupua'a of Kula which stretch from the shoreline to the peak of the mountain. 'A'apueo is located on a high elevated plain of this ahupua'a. This 'ili is surrounded by other 'ili, such as Maka'eha (separated by Kailallnui gulch), Ōma'opio, Keahua, Kailua, and many other *'ili'ili*[3].

Maka'eha: (Lit. sore eyes) Maka'eha is rich with heritage. Much of the upper plains of the Kula region were dry and arid. This had left only a few options for the types of plants that could be cultivated here, and it was the home to one of the best plants that could handle such arid conditions. This area was the home to King Kihapi'ilani's mala 'uala (Sweet Potato Garden). Maka'eha is now called "Pukalani". It takes its name from a hill in the Makulekailua[4] area, which is called "Pu'ukalani (lit. meaning; "Hill to heaven").

Pu'upane: (Lit. hill of answers) Pu'upane resides within the district of Kula. This hill was decreed by a ruling chief of Maui to be sacred. No commoner ascended this hill, for it was a heiau[5] for the high chiefs of Maui, stretching from ancient times until Kihapi'ilani's arrival upon the hill of Pu'upane. A certain *kahuna*[6] lived at 'A'apueo to make certain that no commoner ascended Pu'upane, and allowed only those who were sanctified to do so.

Ōma'opio: (Lit. whistling thrush) Ōma'opio has four registered heiau and numerous ahu[7]. Located at Ōma'opio is a heiau named Mo'omuku[8]. This extensive heiau measured some ninety feet by one hundred and eight feet. Another registered heiau is Mahia heiau, located more to the north than Mo'omuku. This heiau is also smaller than Mo'omuku, at thirty-two feet by forty-one feet. Po'ohinahale heiau is located on the opposite side of Mahia heiau. This may also be the same heiau that is called Kaunuopahu, however the only living informant gave the name Po'ohinahale.

[3] 'Ili'ili: Smaller Land Sections within a specific land division and land section.
[4] Makulekailua(old Kailua), located below what is now Pukalani, above Keahua.
[5] Heiau: Sacred place of worship of various gods.
[6] Kahuna: Spiritual Priest. (Lit. keeper of the secret)
[7] Ahu: Personal platforms of which commoners and royalty alike created to heed offerings to various gods and guardians.
[8] When translated Mo'omuku means "dissected lizard."

'A'apueo: The female deity:

The completion of this report cannot be achieved without the mention of 'A'apueo. In various translations, the term 'A'apueo could mean "the owl's wall." The place name could also reflect the topography of the area, which is encompassed by the 'a'a rock. However, most sources believe the place was named after a female deity. A female by the name of 'A'apueo once resided in this area, and 'til this day the area bears the name 'A'apueo.

Lifestyle:

The word Kula in Hawaiian translates to plain. While this may barely describe some of the topographical features of this ahupua'a, much of its landscape is dry and arid. Therefore, farming was limited to plants that were tolerable to cold evenings and hot tempered days. Although the landscape of Kula has changed considerably over the past two to three hundred years, the climate has remained constant. The scene for most of the landscape was farming families.

It was often documented that the people of Kula were incompetent. This was due to the fact that the people of Kula were not accustomed to the ways of the ocean. Families that lived near the ocean, and those who frequented the shores, mocked the people of Kula who lacked experience in the ocean lifestyle. Therefore, those who lacked the experience needed to master the familiarities of the ocean were deemed incompetent.

Today, Kula is a rapidly changing community, being very different from its scene ten years ago. The area is still largely agriculturally zoned. However, the demand for the suburban lifestyle shows its price, at nearly one million dollars for a choice lot. Its hillsides are abundant with wild deer that were introduced within the last 3 decades, and which is the cause of mass erosion and crop damage to the surrounding areas and farms of Kula.

Many of the culturally significant sights, such as heiau and ahu, are no longer existent due primarily to the "paniolo" age[9]. During this era, much of the land was cleared for the industrially driven use of cattle ranching. Heiau and ahu were plundered without regard for its significance to the area. As mentioned earlier, the ahupua'a of Kula had many heiau and ahu located in 'ili such as Ōma'opio. During the late 1950's and 1960's, the conceptualized "suburbia" became the dream place to live, and thus began the influx of homes and population in Kula. This left little recovery of what had already been destroyed by the paniolo era. Fifty years ago, a Cultural Impact Statement was not an issue, and neither was the significance of documenting Hawaiian antiquities. This is the reason for the lack of information of such items.

[9] Paniolo Age: The era of cowboy influx in the Kula region.

Native Plant Growth:

The vegetation in the Kula and 'A'apueo area do not flourish as generously as various other ahupua'a on Maui.

Every aspect of the traditional lifestyle was closely interconnected with the life forms of these islands. The saying, "He Hawai'i Au" – I am Hawai'i – reveals this basic truth: the people and their environment are one. All of the needs of the population (which numbered nearly as many as those who inhabit Hawai'i today) were provided for abundantly from the life of the land and ocean, created by the stored energy of the sun, and materializing in multitudes of useful and beautiful forms.

Due to the geographic location, as the most isolated land in the world (5,000 miles from the nearest continent), the Hawaiian archipelago evolved incredibly diverse and unique ecosystems, with myriad species of flora and fauna found nowhere else on the planet.

A well-known tree is the sandalwood (Santalum freycinetianum), known in Hawaiian as 'Iliahi. The wood was traditionally used to scent kapa cloth. It was sometimes used to make 'ukeke (a musical bow), the only traditional Hawaiian stringed instrument. The leaves and wood of sandalwood trees were also used medicinally, often in combination with 'awa and other woods. One type of sandalwood, of the lanaiense variety, occurs near the peak of Kula's boundaries. With a red flower, it is found only on East Maui and Lāna'i, and is an endangered species. Only around 100 plants survive today, with a population found on the south slope of Kula.

Other medicinal plants from this area include the 'Ahina Kuahiwi (Gunnera petaloidea), also known as the Ka'ape'ape or 'Ape'ape, and the Mau'u La'ili (sisyrinchium acre), a crawling grass (native iris) found on Kula's highest point. The Mau'u La'ili is used to treat skin disorders.

The durable wood of the golden-flowered lacy Mamane or Kolomona tree (sophora chrysophylla) was utilized to make o'o (digging sticks), house poles, and hōlua sleds.

Most of Kula's landscape is in a fairly dry and arid state, and thus, most plants do not do well in places like these. However, Kula provided a well-balanced dirt, as known today for producing the famous "Maui Onion".

Due to the dry conditions, kalo or taro was not a suitable crop to plant. To supplement the need of wet land kalo, the 'uala (sweet potato) was grown as an alternative. Many sources point to the example of Kihapi'ilani's potato patch in Maka'eha. Sweet potato was just as stable and healthy as kalo, yet required less water to fruit, whereas the kalo grew best in fields of fresh running water.

Another plant that may have grown in this area, to supplement the need of kalo, is 'ulu (artocarpus incisus) or breadfruit. According to "Native Planters In Old Hawai'i: Their life, lore, and environment," written by E.S. Handy et al. explicates, "...early voyagers noted extensive planting of breadfruit along the southern and leeward coast..." Although this statement singles out the Southern and leeward coasts, which are the dryer areas of the island, Kula still made a perfect place for 'ulu to flourish because of its arid plains.

Another blossoming plant that has resided in this area is the 'a'ali'i (dodonaea viscosa) bush. This hard wood native shrub is indigenous to the islands. This plant also grows well in dryer climates. Ranging in heights of one to thirty feet, this shrub/tree is found growing at elevations of up to 8,000 feet, and in wind-swept open country. It is found today in the gulches and surrounding area of this site.

One essential plant used to construct thatched homes was the Pili grass (heterogon contortus). This grass was also quite common in these areas because of the climate conditions. Pili liked to grow in arid and dusty conditions. The Hawaiian people would bunch dried clumps of grass together to create a waterproofed house.

Wildlife:

There is little recorded information about the wildlife in the Kula/'A'apueo region. However, today the area is infested with foreign plants, wild feral, and fowl. This has left much of Kula's natural habitat destroyed.

In 'A'apueo's own region, seldom does the native owl take flight. It is the common barn owl, native to North America, which primarily inhabits the region. The common barn owls tend to be more aggressive in nature, which has caused depletion in other native birds and native plant species.

Conclusion:

Much of 'A'apueo's history lacks in quantitative measures, therefore it is extremely difficult to extract the details of a lifestyle unfamiliar to those of today. The natural habitat is inundated with foreign forest shrubbery and various other plants brought in to "beautify" certain landscapes. An abundance of cactus plants can be seen thriving in the landscape.

The two gulches that sit on either side of the ridge largely protect 'A'apueo. History tells us that this feature was the reason 'A'apueo was a place of great refuge and home to many kahuna who guarded a special heiau with reverence.

Much of Kula's natural and indigenous landscape barely exists. The thinking then, should be to reverse the impact on the land, such as planting shrubs native to the area, desecrate the land as little as possible, and to stop the use of tactics such as those of the "paniolo era". More cautious approaches to certain areas are solutions to the vitality of our Hawai'i.

From all indication, this project will not affect the fauna, flora or endangered species, because it was already impacted by prior agricultural disturbances which occurred on this project area.

'A'apueo I Ka La'i

'A'apueo In Tranquility

'A'APUEO CHANT

Haku Mele - Composer - Charles Kauluwehi Maxwell

In January of 1996, I was invited by Mr. Everett Dowling to accompany him to Kula Malu, in Pukalani, to look at a 5 acre parcel of land that could be used for a Hula Halau. Mr. Dowling, my wife Nina, and I drove onto the site, and as soon as we stopped, a Hawaiian Owl (Pueo) flew from the trees and circled overhead. I said to my wife, "ah Ka Hoailona (the sign)", which meant it was a good omen to have a Pueo flying overhead, leading the way. Our Hawaiian Mo'olelo (Stories) tells us about such events that have occurred in the past. After doing some research, it was found that this area was called 'A'apueo, and it was an Ili (land division) within the Ahupua'a (district) of Kula. This chant came to me, and in 1998 the Pukalani Hula Hale performed the chant at the Merry Monarch Festival.

'A'APUEO

Eia ka hale o 'A'apueo
Here is the home of 'Aapueo
Ke akua wahine o ka uka la
The female goddess of the uplands
I ka wao kanaka o Haleakalā
On the slopes of Haleakalā
Kahi e 'ike I ke konane of Hina La
Where the light of the moon is bright and full
Mai luna mai, kilo akula kona maka
From high above, she searches
I ka waiwai on nā lā'ae ola la
For the riches of days gone by
A me ka pā 'ū o Ha'inakolo
And the skirt of Ha'inakolo
Kāhe'a 'la e ka wena 'ula o ke kalao la
Which is treaded by the red hews of dawn
'A'apueo he nani Maoli nō!
'A'apueo, so beautiful!
Hi'ipoi 'ia I ka poli mehana la
Cradles us in the warm bosom
La'i kū mālie iho nō
Peace and tranquility
Ma ke kīhāpai (o) 'ai Pohaku la
In the well-tended gardens of 'ai Pohaku
Hō'ala hou (i) ka leo o 'A'apueo

The voice of ʻAʻapueo has reawakened
(I ka) ʻāina kappa ʻia I kona inoa la
On the land that bears her name
He Kāhiko luaʻole
A beauty unparalleled
I kea lo kilakila o Haleakala
On the slopes of majestic Haleakalā

CKM CULTURAL RESOURCES

Specializing in Cultural Impact Statements (using State of Hawaii O.E.Q.C. methods), Blessings, Weddings, Lectures and Ho'oponopono

INTERVIEW FORM

NAME – PRINTED: FRANCES K. LAMADORA

SIGNITURE: Frances K. Lamadora

ADDRESS: 3550 HALEAKALA HWY MAKAWAO, HI 96768

TELEPHONE: 572-7341

PLACE OF INTERVIEW: 157 Alea Pl. Pukalani

DATE & TIME OF INTERVIEW: 3/5/03 – 9:10 a.m.

INTERVIEWER: Charles K. Maxwell Sr.

I understand that my statement will be used in a public document and it is my understanding that before it is published, I will have a chance to see it and make corrections if needed. INITIAL: FKL

INTERVIEWERS SIGNITURE: [signature]
DATE & TIME: 3/5/03 – 10:30 a.m.

Francis K. Lamadora Interview Form

CKM CULTURAL RESOURCES

Specializing in Cultural Impact Statements (using State of Hawaii O.E.Q.C. methods), Blessings, Weddings, Lectures and Ho'oponopono

INTERVIEW FORM

NAME – PRINTED: EARL N LAMADORA

SIGNITURE: Earl N. Lamadora

ADDRESS: 3570 HALEAKALA HWY PUKALANI, HI 96768

TELEPHONE: 572-7311 572-7261

PLACE OF INTERVIEW: 157 Alea Place, Pukalani

DATE & TIME OF INTERVIEW: 3/5/03 – 9:10 am

INTERVIEWER: Charles K. Maxwell Sr.

I understand that my statement will be used in a public document and it is my understanding that before it is published, I will have a chance to see it and make corrections if needed. INITIAL: ENL

INTERVIEWERS SIGNITURE:

DATE & TIME: 3/5/03 – 10:30 am

Earl N. Lamadora Interview Form

CKM CULTURAL RESOURCES

CKMculturalresources
157 Alea Place, Pukalani, Maui 96768
Phone: (808)572-8038 – Cell -870-3345

Specializing in Cultural Impact Statements (using State of Hawaii O.E.Q.C. methods), Blessings, Weddings, Lectures and Ho'oponopono

INTERVIEW FORM

NAME – PRINTED: Hōkūlani Holt-Padilla

SIGNITURE: Hōkūlani Holt-Padilla

ADDRESS: 659 Pohala St, Wailuku 96793

TELEPHONE: 244-7569

PLACE OF INTERVIEW: Maui Arts & Cultural

DATE & TIME OF INTERVIEW: 3/10/03 11th am.

INTERVIEWER: Charles K. Maxwell Sr.

I understand that my statement will be used in a public document and it is my understanding that before it is published, I will have a chance to see it and make corrections if needed. INITIAL:

INTERVIEWERS SIGNITURE:

DATE & TIME: 3/10/03

Hōkūlani Holt-Padilla Interview Form

INFORMANTS INTERVIEWS

DATE, TIME & PLACE OF INTERVIEW
March 5th 2003 at 9:00am., interviewed at 157 Alea Place, Pukalani, Maui, HI.

Mrs. Frances Lani Kalani Lamadora
Born 1927 Hali'imaile, Maui
Housewife
3550 Haleakalā Hwy., Pukalani, Maui, HI. 96768

Interviewed at my home. She stated that she was born in Hali'imaile, and when she was a teenager, her family moved to Pukalani. Her home is across the gulch (Makawao area) of the project site. She related that when she was growing up in the area, they used to walk through the gulches, and through the project area. They used to see all kinds of "Hawaiian things" in the gulch, but always remembered what her parents taught them. They were not to touch things, or to be "niele" (curious) when they saw anything that belonged to the ancient culture of Hawai'i.

She recalls that her "Tutu" (grandparent) used to tell her that the real name for the area that they lived in was Maka'eha. Her grandmother used to scold her because they tried to shoot the owls that flew in the area with a slingshot. Her grandmother told her the owl was their Aūmakua (family god), so she should not harm the owl.

She remembers that there was a Heiau (Hawaiian temple) above her home, but she was always told by her parents to stay away from the "stone pile". She does not remember anything about the area being studied, except for the high grass that was growing in the area of the project.

March 5th 2003 at 9:15 am., interviewed at 157 Alea Place, Pukalani, Maui, HI.

Earl N. Lamadora, 30 years old.
Baker – Komoda's Bakery
3550 Haleakala Hwy., Pukalani, Maui, HI. 96768

Interviewed at my home. He stated that he did not know much about the area around his home, and he was always told by his mother not to disturb anything that belonged to the Hawaiian people. He was born in the house that they are living in now. He had nothing further to add. At no time did he see or hear of any cultural gathering in the project site.

March 10th, 2003 at 11:00am., interviewed at the Maui Arts and Cultural Center

Hōkūlani Holt-Padilla
Cultural Specialist- Maui Arts & Cultural Center
659 Pahala St., Wailuku, Maui 96793

Interviewed at her office. Related that she is aware of the project area, and is familiar with the past cultural history of the area. She did not know of any archaeological sites within the study area. However, she is aware of the gulches and ancient Heiau in other areas surrounding the project site.

Note: "Mr. Tadaki of Munekiyo & Hiraga, Inc. initially interviewed me for this report, then the cultural assessment was turned over to CKM Cultural Resources, with Kahu Charles K. Maxwell Sr., writing this report. Because this interview is important for this report, it is submitted with Mr. Tadaki as the interviewer." Certain corrections were made using the Hawaiian Font to the original draft

Interview with: Kahu Charles Kauluwehi Maxwell Sr.

Interviewed by: Glenn Tadaki, Planner
Munekiyo & Hiraga, Inc.

Date: January 29, 2003 at 11:00am., interviewed at office of Munekiyo & Hiraga, Inc., 305 High St. Suite 104, Wailuku, HI. 96793

Kahu (Reverend) Charles Kauluwehi Maxwell Sr. is an ordained Hawaiian priest and a spiritual healer, as well as a well-known cultural practitioner, teacher, lecturer, and resource consultant. He is also an author, songwriter, and host of his own local radio and television shows, as well as the manager of the Pukalani Hula Hale and the executive director of Hui 'Ai Pōhaku Inc., a non-profit organization for the preservation of Hawaiian Culture and Spirituality. In addition, Charles presently serves as the Chair of the Maui/Lanai Island Burial Council, and the Maui member/past chair of the Hawai'i Advisory Committee to the U.S. Civil Rights Commission, and a Hawaiian member of the State Shark Task Force. He is also the Hawaiian Cultural Advisory to the Maui Ocean Center.

Charles was born in Lahaina, Maui, in 1937. Three years later, Charles and his family moved to Kula, where he grew up and was raised. From birth until kindergarten, Charles spoke only Hawaiian, because that was the only language his parents spoke at home. Through public schooling, Charles learned the English language.

As the youngest family member, Charles' parents taught him much about Hawaiian cultural practices, including religious ceremonies for reinterring ancient Hawaiian remains. From the age of 19, Charles handled the reinterment of inadvertently discovered ancient remains.

As a teen, Charles would go into Haleakalā Crater to hunt and camp. During one of his trips, he discovered a cave containing an akua ka'ai (sacred image). The information he gained broadened his understanding of the Hawaiian Culture. This experience, and many others after that, have led to his becoming a member of the State Cave Task Force, which advances the knowledge of burial caves and protects their sacredness for the Hawaiian people.

For 15 years, Charles served as an officer with the Maui Police Department, with 5 of those years being on the island of Moloka'i. In 1974, Charles retired due to injuries sustained in the line of duty.

After being injured, Charles did a lot of research on all phases of the Hawaiian culture, including oral history interviews with Kūpuna (elders). He also became very active in community affairs associated with native Hawaiian rights and culture. For example, Charles served as the first president of the A.L.O.H.A. (Aboriginal Lands of Hawaiian Ancestry) Association and journeyed to Washington D.C. to seek reparations from the federal government for the overthrow of the Hawaiian Monarchy. In 1976, Charles organized and led the first native Hawaiian occupation of Kaho'olawe, to protest the use of the island as a bombing range by the U.S. Navy. Charles was also instrumental in establishing guidelines for subsistence practices for the island, based on ancient Hawaiian methods of fishing. In 1991, when a tiger shark fatally attacked a woman swimming at Olowalu, Charles spearheaded efforts to successfully halt a shark eradication program, on the basis that the shark was the "Aūmakua" (personal god) to some of the Hawaiian families. Charles currently serves as the Hawaiian advisor to the State Shark Task Force. In 1997, Charles spearheaded a drive to stop the selling of t-shirts and other trinkets in Iao Valley. Later, he lobbied the legislator to create laws to put a halt on all sales in State Parks. This law is now in existence.

In regards to the project area, Charles believed that 'A'pueo Parkway was named after the female owl-goddess who lived in the area. Charles wrote a chant about 'A'apueo, which was performed during the annual Merrie Monarch Festivals in Hilo.

In pre-contact times, Charles mentioned that lands in the project area served as the site for the observance of the Makahiki, an annual event held during the months of January and February. During this time, taxes were collected and festivities held. Charles also mentioned that gulches in the area once contained adze factories, and evidence suggests that streams flowed within these gulches at one time.

During post-contact times, Charles indicated that the land, Mauka of the project site (across Kula Highway), was known for having the best sweet potato patches on the island. The sweet potatoes were planted to supply prospectors with food during the

California gold rush. Later, with the advent of cattle ranching, Charles mentioned that the indigenous plants and trees in the area were wiped out, and the forest line was moved further up the slopes of Haleakalā. Without the forests to capture rain clouds and facilitate precipitation, the flowing streams in the gulches ceased to be.

In terms of cultural resources, Charles indicated that he was not aware of, nor had observed, any cultural practices, gathering, or subsistence practices occurring on the land within the project area. In light of the foregoing, the proposed project is not expected to have any adverse impact on native Hawaiian cultural resources, practices and beliefs.

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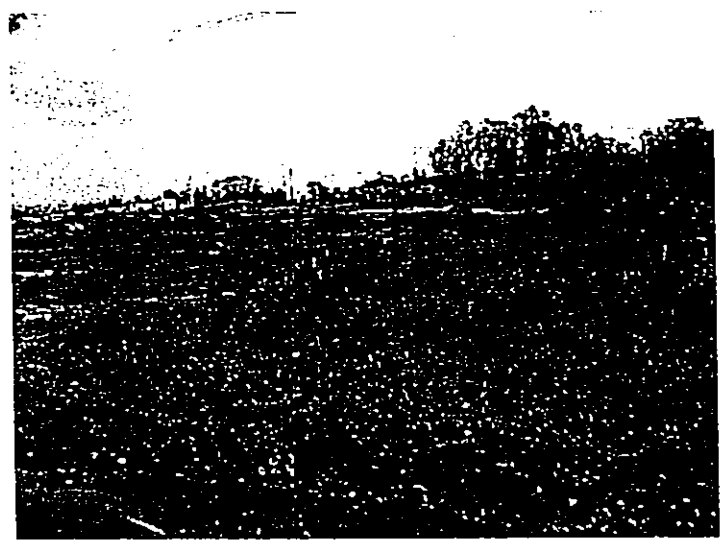
Mauka View of Site

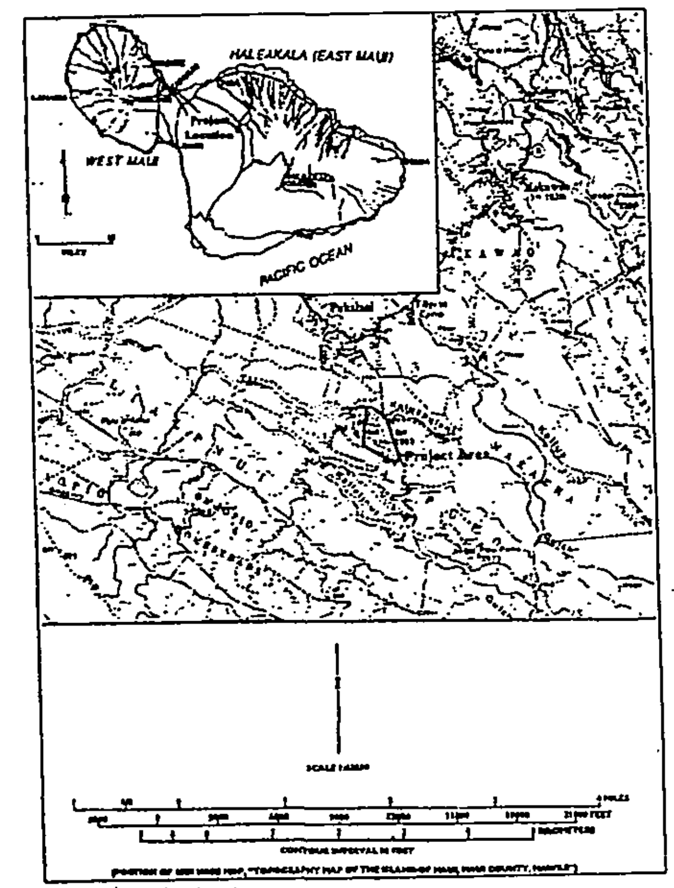
17

View Looking Towards Pā'ia Direction From Site

18



View Toward Haleakalā



Project Location on Maui Island Map

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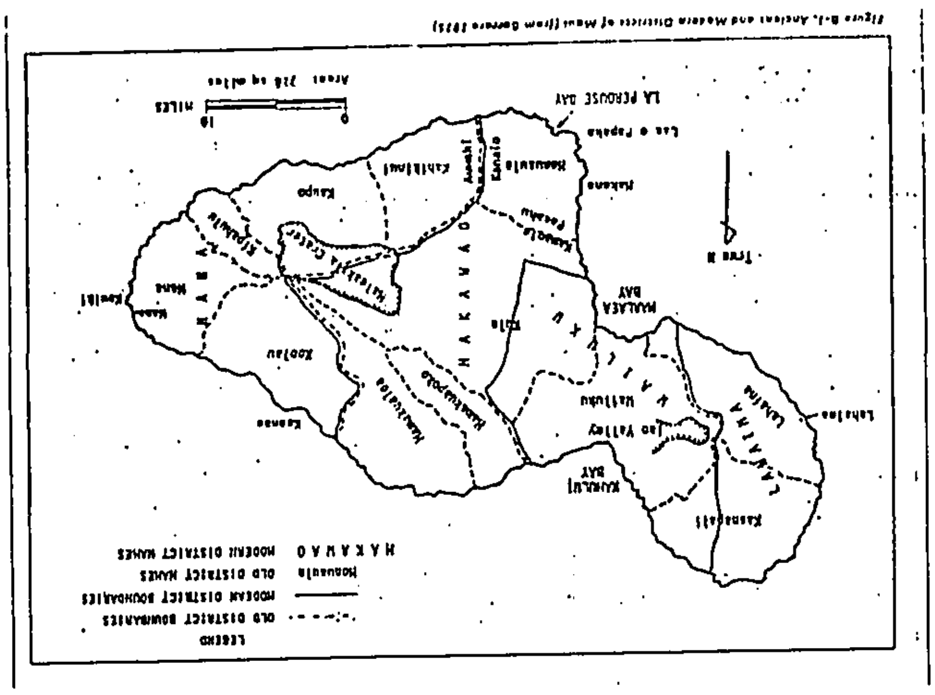
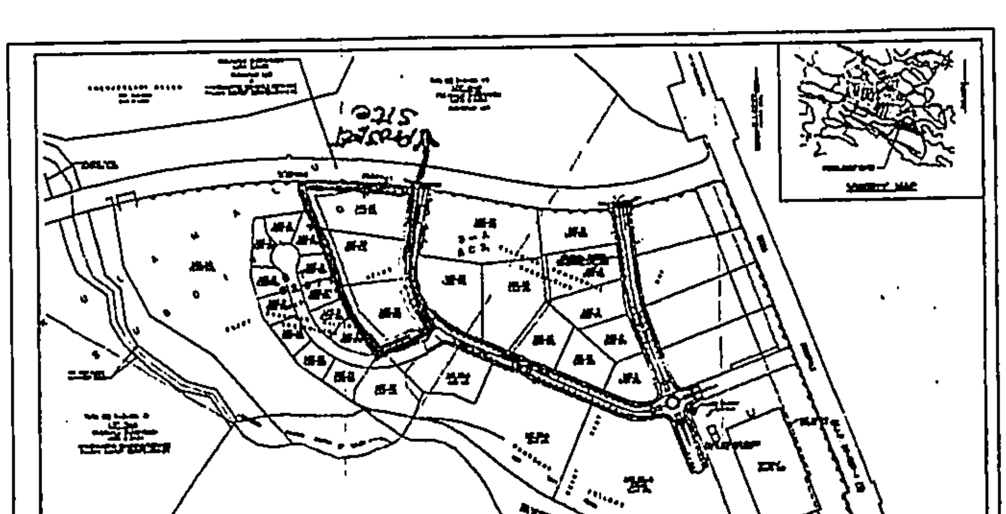


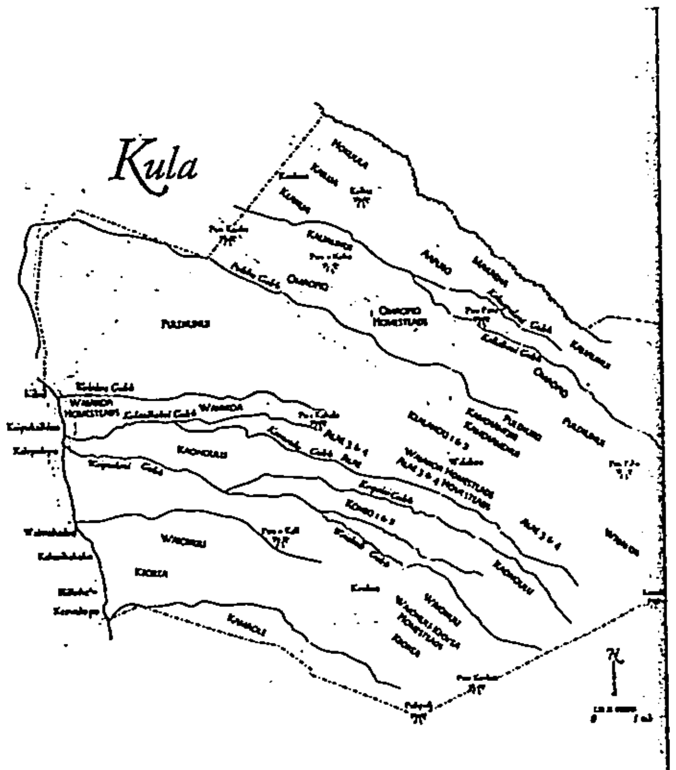
Ancient and Modern Districts of Maui

22



Project Site in Kulamalu Subdivision

21



Kula District | Cultivation

E. S. C. Handy, *Hawaiian Planter*, 61.

Kula was always an arid region, throughout its long, low seashore, vast stony *kula* lands and broad uplands. Both on the coast, where fishing was good, and on the lower westward slopes of Haleakala a considerable population existed. So far as I can learn Kula supported no Hawaiian taro, and the fishermen in this section must have depended for vegetable food mainly on po[i] brought from Waikapu and Wailuku across the plain to supplement their sweet potato staple diet. In recent times, however, Chinese taro has been raised at a considerable elevation.

Kula District

'A'apueo I Ka La'i

'A'apueo In Tranquility

CONCLUSION – *EIA KA LĀKAU*

The University of Hawai'i
Institute For Advanced Technology Astronomy
Kulamalu Town Center, 'A'apueo[1], Maui, Hawai'i
Tax Key #2-3-008:38, 3.425 acre site

Because of the prior disturbance, no cultural or archeological properties were found for preservation. In the 3.425 acre project area, no evidence of past or present use for Hawaiian cultural practices, resources, or beliefs were found in the study area.

That does not mean that this area is free of Hawaiian cultural association. The property is surrounded by gulches (Kalialinui and Kaluapulani) on both sides, which happen to contain the best petroglyphs in the State Of Hawaii. Members of the Polynesian Voyaging Society took rubbings from a petroglyph of a canoe, and used it to fashion the sail for the Hōkule'a (a Hawaiian double-hulled sailing canoe).

An archeological survey was completed of this area in 1996, by McPhater and Rosendahl of PHRI, and no sites were found on this property.

There are no areas of impact from the proposed construction on this site, so mitigation measures are not necessary. This study area does not pose an impact on access rights by Native Hawaiians that would require the use of this area for cultural and spiritual purposes.

[1] 'A'apueo is a female goddess of all the owl 'aumakua (personal god). W.H. Uaua, The Legend of the Battle of the Owls, *KeAu Okoa*, June 29 1871, 2. MS SC. Sterling 3.12.3.

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